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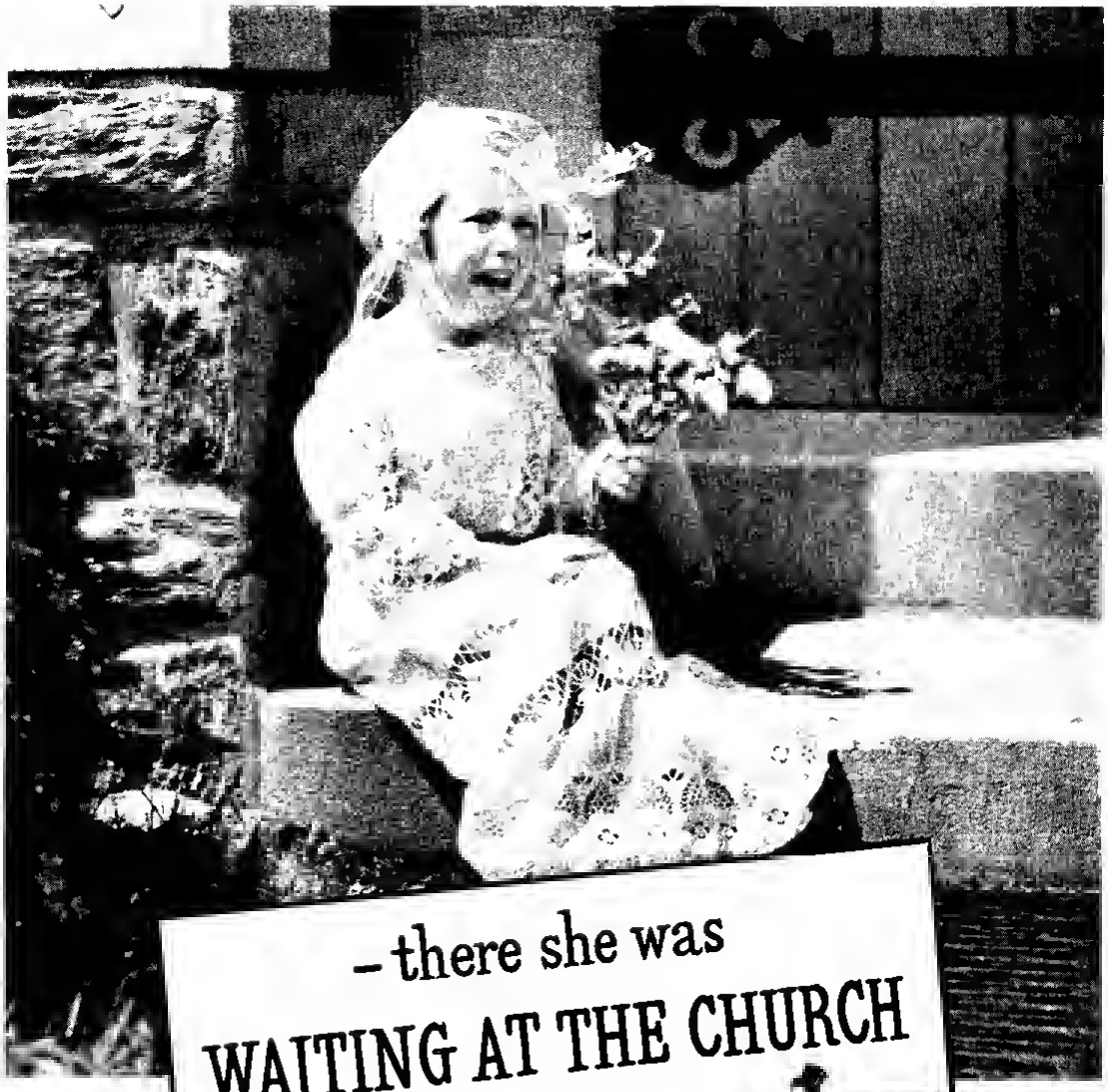

–there she was WAITING AT THE CHURCH

. . . waiting at the church because the cutest boy in the neighborhood, playing "groom" to her "bride," walked out on her—*and told her why.* Lucky little Edna, to learn so young, that halitosis (bad breath) is the fault unpardonable. Later in life, radiant, beautiful, sought after, she always used Listerine Antiseptic to make her breath agreeable.

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January, 1938

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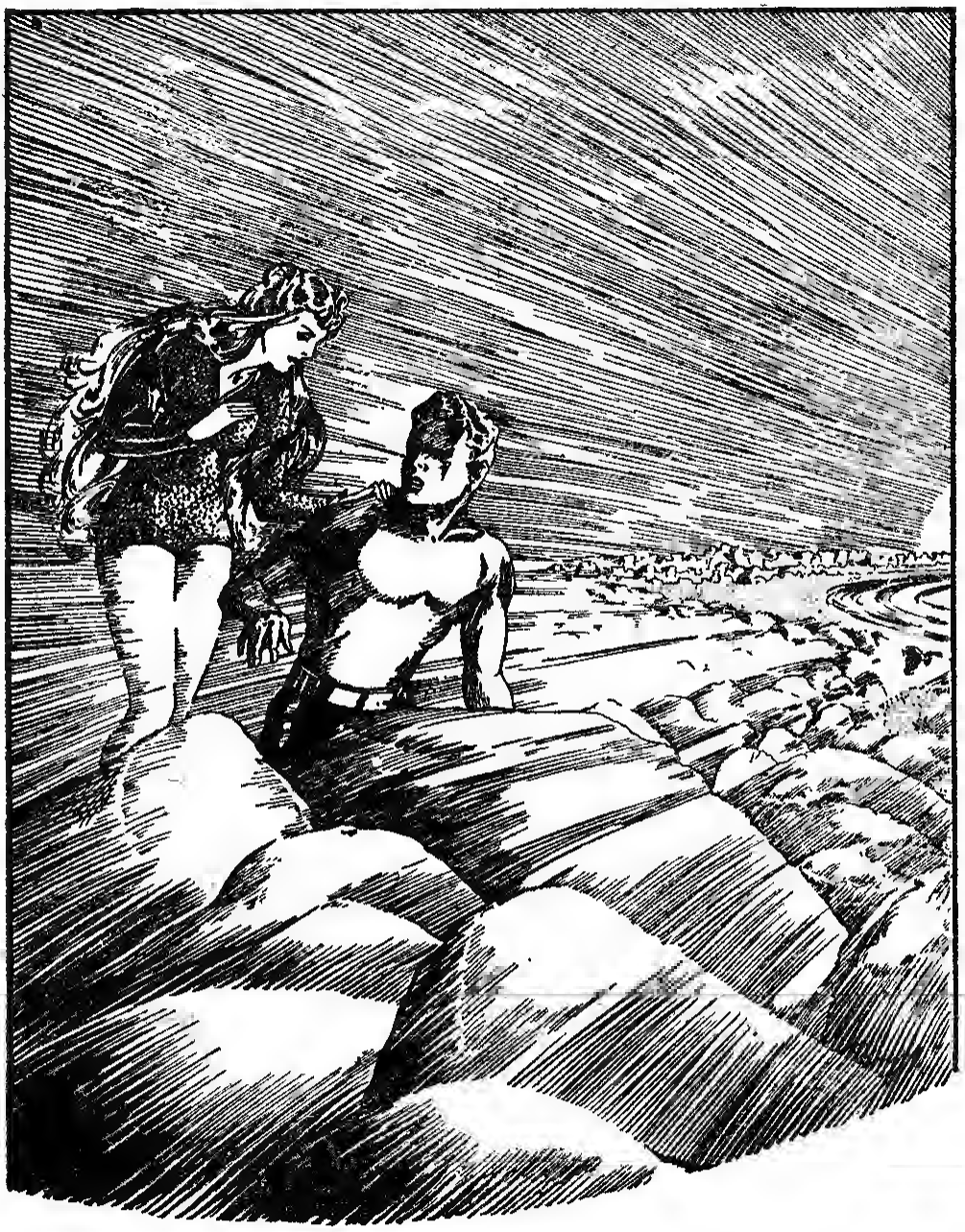
In Times To Come

This new feature of ASTOUNDING is going to be devoted to predictions. One of the first predictions we will make is this: IN TIMES TO COME will appear as regularly as I can squeeze it in. And another is that, being made up by humans, it may err, but only when I cannot avoid delay.

Part of this column's function has been usurped this time by the Editor's Page—as it will be each time some item of such importance is to be announced. But that February issue of ASTOUNDING will be worth our while. For one thing, besides the **mutant** feature, a succession of unusually good stories has contributed to it. I said in the December issue I was looking for new authors? They're beginning to appear. M. Schere with "Anachronistic Optics" is one I'm glad to have found. Kent Casey, a new man—and an Army man himself—seems mighty promising in "Flareback."

But the backbone of the issue will be stories by our old favorites, and a stellar collection of them—Arthur Burks with an antarctic story "The Fatal Quadrant." Eando Binder, Gallun, and Gordon A. Giles are back. Willy Ley continues the short series of articles on future sources of power with "Harnessing Earth's Heat." And Robert Moore Williams has done a beautiful job on "Flight of the Dawn Star"—a tale I'm sure you'll like.

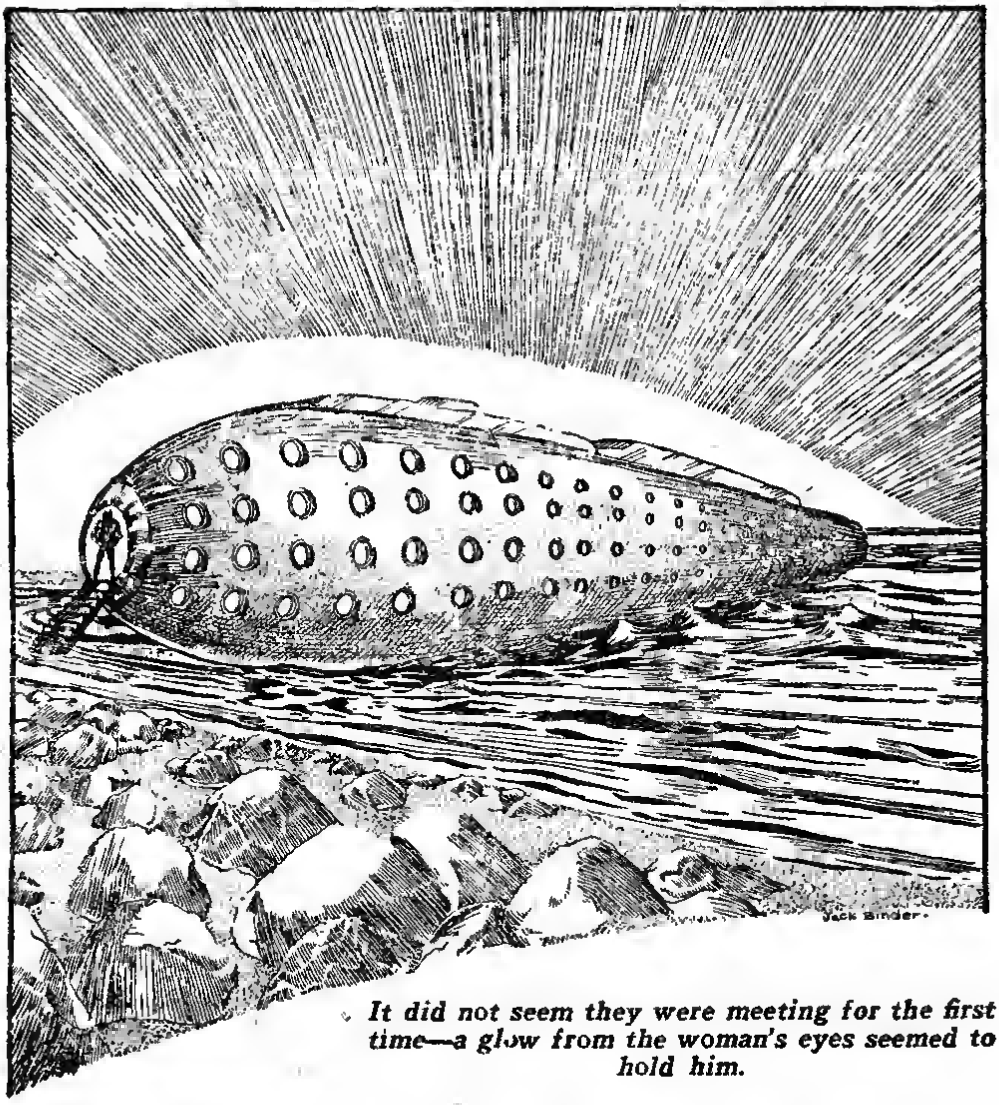
But speaking of likes and dislikes—I keep a chart with little check-marks for each favorable comment a story receives from your letters. If you want to see more of a certain type of story predicted here IN TIMES TO COME, you do your predicting in letters in Brass Tacks. THE EDITOR.



Ormoly of Roonerion

by

Warner Van Lorne



It did not seem they were meeting for the first time—a glow from the woman's eyes seemed to hold him.

A man answers to the urging call of a strange light——

I.

THE SUN was sinking over the water as Jack Bissler turned toward his cottage. The crowd on the beach was beginning to thin—drifting toward home and dinner.

Jack loved to walk the sand at the water's edge, where the waves rolled almost to his feet. It was like a private game of tag—and sometimes he was caught off guard.

Suddenly he stopped to stare! Minutes passed, and still he didn't move. He stood with one foot forward, as if cut from stone.

A pin point of light, too vague to know what caused it, shone a few feet

from shore. It gripped his whole being, seeming to touch a cord within his mind and play a tune of far-off places.

Time slipped by, and still Jack Bissler did not move. The pin point of glowing light held him fascinated—more than fascinated—spellbound! The luster of a ruby, with the changing light of a diamond, seemed to emanate from that spot and send a radio wave to his inner self.

When Jack staggered back, the light had gone. As long as the glow remained he was rooted to the spot. His eyes searched frantically for a recurrence of the phenomenon; he wanted to glimpse it again, wanted it with more desire than he had ever known before.

He wandered slowly along the beach, and now the waves touched his feet unheeded. His eyes didn't leave the water for a moment, but continued their constant searching.

When darkness came he was still searching. He retraced his steps and followed the beach in the other direction, but it was useless. The moon had been down several hours when at last he turned toward bis cottage and a bite of food.

That night he did not sleep but tossed constantly while changing lights flashed on and off within his mind. They remained as clear as the moment he first saw them, and held that same intense appeal.

JACK BISSLER had finished school the spring before, and was disappointed at his reception in the business world. He was offered more than one position, but none that paid much of a salary. A slow realization that he couldn't find a decently paid position seeped into his mind, and for the first time he questioned his own worth.

After the reception Jack received, he decided to enjoy the summer and continue the search for employment in the fall.

His father had left sufficient money to carry him through school, but very little over. Renting a cottage at the beach ate into his last bit of capital, and would leave him penniless at the end of the season. He could not afford even this, but some strong longing had found content only here at the seashore.

To his neighbors he was a source of comment. He lived alone and did not welcome company. Twice when they called he had been almost rude and they ceased to bother. He wanted to be let alone and was not bashful about showing it.

To the girl in the next cottage it was an insult. She had done everything but fall over the fence between them, yet he hadn't shown the slightest sign that he knew she existed—and she was not hard to look at, in an abbreviated bathing suit. At least every one else looked!

She even tried an act of drowning—at the proper moment—but Jack Bissler let her be "saved" by a more anxious male while he smiled; she had demonstrated her aquatic competence to him on other occasions.

Bissler was not interested in girls. He felt it would be time enough to show interest when he had made a mark in the world. Furthermore, his money was running short and they would expect some entertainment besides swimming.

WHEN DAWN broke, Jack gave a sigh of relief and ate a hurried breakfast. The strange light that he had seen the night before was still foremost in his mind. It had taken possession of his brain, to relegate everything else to the background.

He paced the sand hour after hour, watching the edge of the water constantly. But there was no repetition of the light. His swim was forgotten, luncheon passed and still be walked the beach.

His head ached from racking his brain for some clue to the exact spot where

the glow appeared the night before, but there was nothing. He hadn't marked the place in his mind and his wandering had covered miles.

Before dark the cottagers were watching him closely, and his actions gave a new topic of conversation.

The next morning when he was seen walking the sand just after daylight, it led to speculation as to whether he had walked all night. People began to remember many of his actions that took on peculiar aspects now. Early risers looked at him queerly, and Jack realized that his actions were causing comment.

By noon, people were keeping away from him. Bissler knew the authorities would be inquiring into his actions, so he found a place on the sand with an unobstructed view and remained there the rest of the day. This action didn't arouse the feelings of the cottagers, although they gave him a wide berth.

The sea was exceptionally calm as the sixth day of constant watching drew toward a close. Jack began to wonder if it was solely his imagination.

The bathers had gone home; the sand was almost deserted. Then Bissler's tired eyes, wandering along the edge of the almost glass-smooth water, suddenly brightened.

The light!

It was only a flash, but Jack knew his waiting had not been in vain. A moment later he stood at the edge of the water with the sea slapping around his feet. Minutes passed and the twilight deepened into night. Still the man waited. He knew it would come! It seemed almost part of himself. *It must come back!*

Since his first glimpse of the light there had been a change in his life. College, business, even the world he had always known seemed to have lost importance. The one thing that mattered was the return of the light!

The noise from near-by cottages had quieted when the glow came again. Bissler was glad! He could view the radiance without any one knowing.

The light was dim at first, but increased in brightness until it seemed to cast a tangible beam to the man. Gradually it drew nearer, to stop almost at his feet. It had reached the edge of the water and could come no farther.

Jack bent over, his eyes glued to the bright spot. Time passed, and still the light remained. There appeared to be an object at the source, but it was too tiny to be certain.

Slowly the water receded until the bright spot lay on the sand—and it was *growing larger!* It expanded as the man watched until it was several inches long. It seemed to draw slowly away at the same time, and Jack took several hurried steps forward.

He almost fell and discovered he was standing on rocks larger than his feet! He could not understand; there was little room for anything in his mind, but that he must absorb as much of the strange light as he could.

When the object had grown in size, so that he looked straight ahead, he stepped forward again. It appeared to be metal now, and almost cigar-shaped. The light came from many small openings in the silvery material.

Once more Jack started forward, but now he had to climb over boulders so huge that the ship was almost out of sight when he dropped into the hollows between. A few feet from the ship he stopped on top of the highest. The strange hull was enormous now. It stood fully sixty feet high and several times that length.

Port holes, a foot in diameter, were visible, with rays coming from several. As the ship ceased to expand, the lights faded until they gave only a faint glow.

JACK GLANCED around hurriedly, but nothing was familiar. Only the silver ship remained, to blot out everything in that direction. It *couldn't* be

real! It *must* be a dream that would soon be shattered by awakening.

Bissler sank down on the rock and buried his face in his hands. There was no need of torturing his brain with sight of the ship when he would awaken shortly to find himself in his own bed.

Suddenly a hand dropped on bis shoulder, and a soft voice spoke. "Ormoly!"

It was the voice of a woman! For a minute Jack was still, but appeal and happiness in the voice drew his eyes up.

For a long time neither man nor woman moved. They looked deep into each other's eyes. They did not seem to be meeting for the first time, but simply renewing an old friendship.

A glow from the eyes of the woman seemed to reach out to the eyes of the man and hold them. When the glow faded from her eyes Jack looked away.

Then he looked at her again. Slender arms ended in long tapering fingers. The tight-fitting bodice of silver metallic cloth which hung slightly below the waist emphasized the slim, curving figure.

His examination was so searching, so thorough, that he felt embarrassed. But when he glanced at her face she was smiling. It pleased her to have Jack display interest.

Golden hair fell to her waist to surround the greenish tint of her face. When he looked at her eyes, he found the answer to the light they seemed to emanate. The pupil was clear as a cut diamond set within a circle of yellow gold! Her skin was almost a green gold, blending softly with the other coloring. It was a strange combination, yet very pleasing.

She stretched forth her hand and helped Jack to his feet. Together they walked to the ship and mounted a short flight of steps. As they entered an opening in the side, an old man of the same golden race, bowed low. When they passed he spoke one word. "Ormoly!"

The sound of that word brought back memory of the girl's voice when she first touched him. The word "Ormoly" carried some meaning, was more than a greeting.

Bissler knew that he was among friends, even though they were of an alien race, and was perfectly willing to be friendly. And he didn't care to stay on that rocky shore. Even within the hull of the ship the vast booming of giant waves could be beard in the distance.

EVERYTHING was of metal. As they walk along a passageway, Jack noticed that smooth panels dotted the sides. The Earthman would not have recognized them for doorways, but for two that were slid into the wall, revealing the openings.

The ship was blazing with light from slits in the metal ceiling. These people seemed to disregard the waste of power, to use it extravagantly.

They followed the passage a hundred feet before reaching a room at the end, where the girl hesitated for Jack to look around. She seemed proud of the ship and wanted him to like it.

The room was thirty feet long by twenty wide, with panels in the side walls. Two passageways opened on the opposite end, leading to other parts of the ship. The ceiling curved toward the two side walls, but ran straight from end to end—like a slightly curved piece of metal.

Luxurious furnishings in front of the blank wall spaces included two inviting couches. The frames were of metal, but the upholstery was similar to leather. Six easy chairs and three small tables completed the furnishings around the walls, while a dining table and three chairs occupied the center. Three places were set at the table, with dishes of food at each.

The old man joined them and spoke

to the girl before Jack finished his scrutiny of the main cabin. She left them to enter a door in the right-hand wall. For a fraction of a step she hesitated before the panel, then it slid back out of sight to close silently behind her. Bissler didn't see her touch the surface, yet it opened when she desired.

The old man motioned for him to follow, and led the way to one of the doorways on the left. When he hesitated before that panel, it slid back without effort and Jack followed within.

While the golden man slid open a small panel in the wall and brought forth a metallic garment, similar to the ones he and the girl wore, Jack looked this room over.

Five feet above the floor there was a framework which hollowed considerably from the sides toward the center, but was evidently meant for sleeping. It required a small ladder to reach from the floor, but it must be the proper place to spend a night. One uncomfortable-looking three-legged stool completed the furnishing.

The old man grew impatient while Bissler examined the room. Handing Jack the metallic garment, he hurried out, helping the panel to slide faster in his rush.

The close-fitting material of the garment proved softer than the Earthman expected and was fairly comfortable. But he hated to discard his bathing trunks.

When he approached the door to see how it operated, it slid back and he walked through. The old man was just returning from the passage where they had entered the ship.

He motioned to Jack and they took seats at the table. The girl came from the other doorway and started toward them.

Bissler jumped to his feet to slide her chair back from the table, only to have the man shove him back into his seat. The girl turned and ran back into her room, while the old man glared as if Jack had broken all the laws of etiquette.

Several minutes passed before the girl came forth again. This time Jack kept his seat. When she reached the table she moved her chair slightly toward Bissler, much to the discomfiture of the older man.

Without glancing up from their plates, the two strangers started the meal. At last the Earthman tried some of his food, then ate it. It was different from anything he had ever tasted, but quite relishable. To Jack, it looked like chop-suey but tasted like beef stew flavored with strong cheese.

The meal continued while the golden people kept their eyes on their own plates. Bissler began to feel that moving her chair must have been a terrible blunder to have them avoid looking at him for so long.

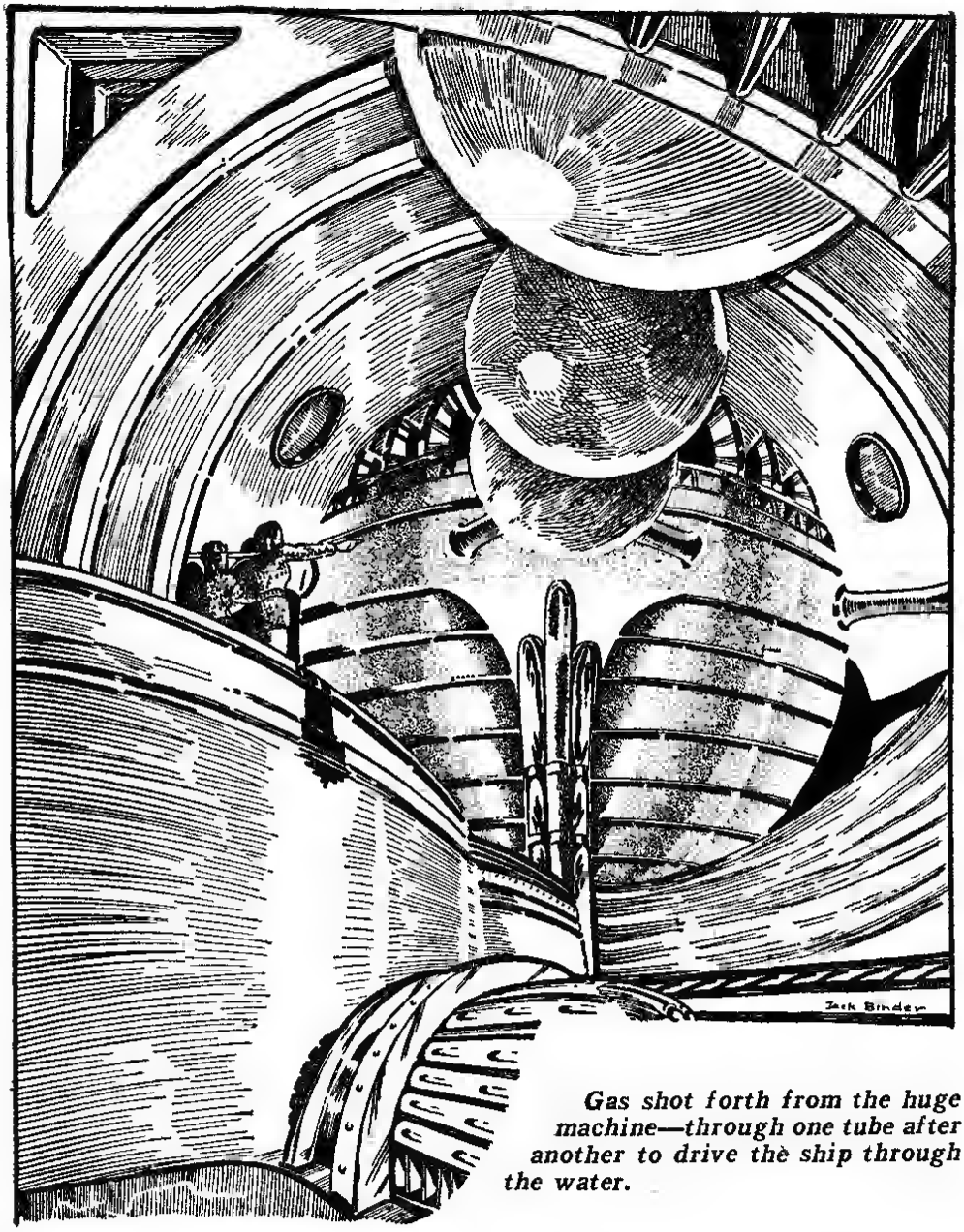
They finished long before he did, but did not glance up until his food was gone. Then conversation started as if a silencer had been lifted.

Suddenly the ship lurched as if struck by some heavy object and they sprawled on the floor. Before Jack knew what happened, the old man dashed down one of the passages. A moment later the vibration of powerful machinery could be felt through the metal.

When the ship lurched a second time, it seemed to spring forward and for several minutes it shook as if in the teeth of terrific forces. Slowly the vibration lessened and the feeling of motion smoothed out, became a steady rhythm.

Nothing in the room had been disturbed but the dining chairs and dishes. Even the table was fastened down. When Jack got to his feet he looked for the golden girl. She lay where she had fallen—a bump on her forehead!

She was in Jack's arms when the golden man returned. For a moment the older man hesitated, then motioned



Gas shot forth from the huge machine—through one tube after another to drive the ship through the water.

toward one of the couches and the Earthman laid his burden down carefully.

From a panel in the wall the old man brought lotion to bathe her forehead. Several times he glanced at Jack questioningly as he saw the anxious look in his eyes. Then a smile spread slowly over his face and he looked away.

When the girl showed signs of returning consciousness, the old man handed Bissler the lotion. He stopped as he reached the doorway. His smile broadened at sight of the stranger beside the couch. Then with a sigh he went on toward the purring hum of machinery.

II.

HIS FEET dragged, he was tired, very tired from the strain of the last few hours. Now that the ship was safe at sea and under three *tols* of water he would rest easier. He had worried for fear they could not pull clear of the giant waves on the unfriendly shore. But they succeeded without damage to the hull.

Storic Polloy was proud of his work. He looked forward to the greeting he would receive from the six other members of the Goran. They had questioned the ability of one man to manage such a huge ship and carry through the plan alone. But there had been no other way, and it had been decided to let Storic handle every detail.

Jack Bissler watched anxiously as the girl opened her eyes. For a moment she was startled, then she smiled faintly.

When she glanced down, Jack realized he held one of her hands very tight. She still watched him as she worked her fingers to restore circulation, then tucked them back within his hand.

This time he held it tenderly. It was the first time he had ever noticed the size of his hands. Beside hers they were enormous, yet he could not recall that they seemed big compared to men he had known.

When the Earthman pointed to the bump on her forehead, the golden girl laughed. A moment later she stood on her feet, still holding tight to Jack's fingers. Then she led the way down the passage that paralleled the one the older man had used.

This passage ended thirty feet from the main cabin, at a spiral stairway leading up and down. A hum of machinery came from the lower well. When the girl turned up the stairs Jack was slightly disappointed.

On the level directly above the cabin a passage ran the length of the ship, with door-panels on both sides. After passing several, they reached an archway. It was the first opening without a panel that Jack had seen. He hesitated before entering.

The archway opened into a lounge room, with comfortable chairs on a thick carpet. It was the first sign of floor covering in the ship and he stepped forward eagerly. It felt good to have something other than metal under his bare feet. He noticed that small panels filled the walls from ceiling to floor.

The golden girl was very proud as she pointed to the various pieces of furniture. She seated Bissler in one of the chairs and opened the small panels one at a time.

To the surprise of the Earthman they covered books, with shelf after shelf filled with various sizes. Only two of the panels hid other objects. Behind one was a sheet of frosted material, similar to glass, fitted tight to the surrounding metal. The other contained a machine of complex design, so Jack turned his attention back to the books.

They were of metal, yet as light as the books of paper he had been accustomed to. There the similarity ended. The top cover was loose, but he could find no way to turn the pages, and the writing appeared like Chinese.

He still puzzled about, handling them, when the girl came to his rescue. In her hands, the book showed signs of being made by an intelligent being.

The upper cover was removed and fitted into a slot in the end of the back cover, so that they completed a long board with the joint at the center. Instead of a hinge on the left side of the pages, there was one above, and the thin metal sheets folded from the bottom to the top half of the cover. Upon pressing a small button on the lower right-hand corner of the covers, the pages automatically folded back one at a time.

After watching the pages swing over in the hands of the girl, Jack spent several minutes learning to manipulate it.

Each time the button was pressed, one of the pages rose of its own accord to lay flat in the upper section.

WHEN Jack tired of examining the books, the girl pointed to first one object then another, speaking at the same time. Soon Jack understood and named each article after her.

Before long he knew what a table was, then a chair, and finally they both laughed as the girl pointed to one of her small bare toes and said, *"Bic."*

While Jack was being introduced to the new language, she kept her hand in his. Twice when he let go of her fingers, to use both hands, she had timidly stretched them forth again.

He found his eyes drawn back to her as if by a magnet. He wanted to hold her hand and felt bewildered, as if he had learned of something that he hadn't known existed.

When he pointed to her, she did not understand. Then when he pointed to himself and said "Jack," she became more puzzled. At last, when she understood, she pointed to him, said "Jack" and shook her head. Then she pointed again and said "Ormoly."

As the girl spoke his Roonerion name she turned her eyes away, shyly, and color slowly crept up her neck. Then she squeezed Jack's fingers and glanced at him again.

Now it was Bissler's turn to be puzzled. They were giving him the name Ormoly, yet it carried some hidden meaning to these people which had an odd effect on their feelings when they spoke it.

When the girl pointed to herself and said "Mordin," Jack knew it might be either name or title.

When a red tint appeared in the glow of light, the girl glanced up, startled, then led the way back to the main cabin. The golden man was waiting and spoke to Mordin as they entered.

Turning to Jack, he pointed to the room where he had given the Earthman the metallic garment earlier in the evening and nodded. It was more than an invitation and Bissler started.

While the Earthman was deciding the proper way to mount the bed, he racked his brain for the reason for his friendly reception. It had seemed very satisfying to the old man to have him care for the golden girl, yet it would have been more natural if he had resented the sudden and evident interest Jack displayed.

Bissler could find no way to turn off the glow from the slits in the ceiling and the light bothered him. But he made the best of it and tried to get to sleep. Twice more the red glow appeared in the light, to mark off time. He fell asleep trying to solve the riddle of what strange molecular expansion had caused the ship to enlarge while he watched.

When his eyes opened, Jack knew he had slept many hours. For a long time he lay still, hoping the others would call him as soon as they were up. At last he donned his garment. After several experiments he found a panel which concealed toilet equipment and succeeded in washing the sleep from his eyes.

He took a bath in the first place, with his garment on, when he tried one of the buttons on the wall. The panel closed over a curved section of wall about six feet high, and the water came from a jet in the top of the opening.

When Jack pressed a button experimentally, a stream of water shot down from the ceiling and covered him from head to foot. After jumping back, he discovered a recessed basin that could be swung out into the stream of water. When he tried it in position, the water hit without splashing beyond the edge of the bowl. For several minutes he examined the peculiarly curved edges, which turned the water back to the center without allowing it to spatter.

They had the most compact toilet

equipment he had ever seen, with a space no larger than that ordinarily occupied by a wash bowl alone being used for shower as well.

To his amazement the metal garment was dry by the time he had finished washing and he entered the main cabin. There was no one in sight, but a place was left for him at the table with food waiting.

WHEN he was half through the meal, the girl came down one of the passages. As he turned to look, she stopped, then hurried back the way she had come without a greeting.

For a moment he gazed after her, then shrugging his shoulders continued the meal—he was hungry, whether they liked it or not.

There was no further sign of the girl. When he finished eating he followed the passage where she had gone.

It ended in the control room in the front of the ship. The golden man was busy over charts, while the girl watched. Before them was a huge board, covered with levers and gauges. There were hundreds of dials and Jack wondered that any one could understand the use of each.

They hadn't discovered him and he watched for several minutes. Twice the man reached to a lever beside one of the gauges. The rush of water against the visi-plate told of their terrific speed. Jack wondered at the seeming carelessness with which the ship was allowed to travel. If they should hit any submerged object, it would smash things up generally. They did not appear to be far beneath the surface, as light sifted down through the water to catch on minute objects.

Once a blue light flashed, the ship swerved of its own accord, then went on after curving back to the original direction. The flashing light drew the golden man's attention, but he merely watched as the ship changed its course, then corrected itself after a moment.

When the Earthman was discovered, he was greeted by smiles. He was just as welcome as the evening before and the three people went down the passage together.

There seemed to be a slight argument between the man and girl, although Jack couldn't understand what they were saying. At last the girl gave in and the man led the way.

They followed the other passage to the stair-well and to Bissler's satisfaction turned toward the hum of machinery.

The stairway ended in a room the length and width of the ship. Machinery filled all available space, as far as the Earthman could see.

Some of the machines were fastened to the metal floor; others reached below the level on which they stood. The largest piece of equipment reached from below the floor to a curved dome in the ceiling above. It throbbed with life. Jack knew it was the main driving mechanism of the huge ship.

Many of the smaller machines were almost recognizable as generators and electric motors. But his attention kept returning to the huge machine which dwarfed all else. He could find no source of power to operate it. There was no storage space for fuel, yet it must consume a terrific amount of energy.

As they passed around the farther side, the Earthman stopped to examine a small boxlike section with a clear plate in the top. It appeared to be some type of cooling apparatus. Water flowed in through a pipe from the hull, but there was no outlet. For a long time Bissler watched the movement of water beneath the plate. It came in, but he gave up trying to locate the outlet in the hull.

This was the part of the ship which was the personal pride of the golden man and he displayed each piece of equipment proudly. He led the way to

a small visi-plate in the side of the hull, just beyond the end of large tubes.

FOR A MOMENT Jack did not understand, then the truth struck him. The ship was not driven by mechanical power! *Gas* was shot forth from one tube and then another, to push against the water and drive the ship ahead. There were eighteen tubes in all and the bubbles of gas came from first one and then another, to eliminate any sudden push at one spot and lessen the vibration. For a long time the Earthman watched the display of power and wondered where they could obtain such huge quantities of gas.

The central machine throbbed and pulsed with the effort of pushing the gas against the water. It required terrific pressure and Jack looked at the massive machine with new respect.

When they returned to the main cabin, the girl took Jack to the lounge room and went on with his education. Every object pictured in the books was named, until his head ached from trying to remember.

Every moment they were not sleeping or eating was spent cramming his mind with the new language. Gradually Jack became able to carry on a simple conversation. From then on he learned swiftly.

Several times he questioned the girl about the strange ship, but was always told to wait. When he tried the old man, he received the same response.

Weeks passed and the Earthman began to read. His understanding of the Roonerion language had reached the point where few words were beyond his use and he learned some of the customs.

It was considered terribly impolite to look at a person when they were eating. At that time they appeared to the greatest disadvantage and eating was done with as little fuss as possible. The only proper way was to keep your eyes on your own plate and not talk until the meal was finished. Yet it was impolite to eat alone, when it was possible to have company.

The reason he could not stand up, or move the girl's chair at the table, was quite simple. Men took their places first, left the choice of seats to the women. A woman was privileged to occupy any place she desired and movement of her chair toward a man was an indication that she chose him for her companion. If a man moved a woman's chair, it signified lack of respect.

Jack's education continued, to cover every custom. He learned how to meet people for the first time, and how to greet old friends. Every custom they had seemed so much stiffer than any he had known before. Holding a girl's hand meant as much to these people as a kiss would have to the girls he had always known.

When he inquired about the length of the trip, he was told it would last several weeks longer. He could not understand that. They were traveling several times as fast as an ocean liner. It would seem they should have gone all the way around the Earth.

The charts that Storic Polloy used for navigation were very odd. Jack couldn't find a single piece of land or water that looked familiar. He began to wonder if he had been transferred to some other planet.

Mordin kept up the lessons day after day and explained that his education must be complete by the time they reached their destination, but she would say no more.

III.

FOLLOWING a simple mastery of the language, Storic Polloy continued Jack's education with the mechanical part of the ship. It seemed strange that they should want him educated so completely in their mode of living, but he

was anxious to learn of their wonderful mechanical development.

Power for all machinery came from the central unit which drove the ship. Gas pressure drove even the small electric generators. Storic seemed slightly surprised that the Earthman understood any of the machinery, but it simplified his teaching.

Several days were spent on different types of mechanical units, until Jack had a general idea of the operation and control of the Roonamere. The huge ship was taking on a different aspect, becoming something within the Earthman's understanding.

When the day came that they approached the huge central machine, Jack grew excited. It had drawn his eyes many times when his mind should have been on other machinery. But the old man started his education at the beginning and went over every simple unit, before coming to the master machine.

The Earthman listened intently, as the old man talked——

"Our civilization of Roonerion is more ancient than your histories. When your race was in a semicivilized state, we lived in the height of comfort. At times we have slipped back, but for only a short time. Our civilization has never been lost, but has carried on from generation to generation.

"We have mastered many angles of science which are still far beyond the reach of your people. This has been accomplished through a peculiar advantage which we have, and which you will learn of a little later.

"If you will notice the water flowing beneath the visi-plate at the end of the machine, you will see that it appears much coarser than it normally would."

For several minutes Jack watched the flow of clear liquid. To his amazement it *did* appear coarse—almost as if it were made up of particles. Then he turned his attention back to the golden man.

"We have the advantage that matter appears much larger to us than it does to the people of your race. It appears the same way to you now. Then through a series of magnifying stages, it is brought to the point where the various parts can be seen quite clearly. In this way we were able to analyze water and discover why the atoms of hydrogen and oxygen hold in a mass as they do.

"This work required generations, but it was finally brought to the point where it became of use. Hundreds of our scientists labored throughout their lifetimes to accomplish the result.

"When it was completed, it meant power that was undreamed of before. They discovered another part of matter within the atom which was all-important. This other discovery gave the key to all things which had puzzled men from the time they knew that the atom existed.

"It was found with every type of atom, in every element that has ever been discovered. So it is of vastly more importance than the atom itself.

"For a long time we puzzled over the action of the atoms in holding any set form. We even went so far as to search the atom for the answer, but only found smaller units of energy which were as minute to the atom as the atom is to the element.

"So we went still deeper and found another smaller unit of energy, but no answer to our problem. It fell to the lot of a young scientist to discover what we needed.

"The parts of an atom have a habit of moving, without seeming loss of energy, but the scientists discovered a way to slow them down so a complete search could be made. But the reason for the constant motion was not known.

"When this young scientist came out with the statement that they had been searching much deeper than necessary, no one believed him. It took the re-

mainder of his life to carry out his work and prove his theory correct. If he had been believed, the work might have been completed within a few years.

"He proved that atoms floated in a sea of tenacious fluid which controlled them completely. Only as the viscid solution was related to other fluid of similar nature could two materials be joined together.

"Water contained hydrogen and oxygen in set proportion, because this viscid solution gathered them and held them in that ratio. Every element was the same, with its own peculiar tenacious substance.

"WHEN this fact became known, scientists began working from an entirely different angle. Breaking down this fluid would free atoms for any use desired.

"Water was the substance easiest to obtain and sufficient for any power. So it was the substance used for further study.

"It was many years after the discovery of the viscid quality in matter before science devised a way to destroy it. But the day came when they were able to free the atom with little difficulty.

"When this was accomplished, it was only a step to the generation of power. With hydrogen and oxygen atoms in the free state, they were highly explosive.

"The water that you see flowing into the machine is transformed inside. When it is freed of the binding qualities it is simple to fire the hydrogen, with the oxygen to supply the other element necessary. The result is an explosive of great power. The gas which is blown out through the tubes to drive the ship is the result of the process of separation and firing. The overbalance of the two atoms goes out as waste with the gases.

"The amount of water consumed in this way is very small, but quite a volume of water is used in its natural state to give added power to the gases. The steam in the clouds of gas gives more power, due to the added weight.

"So far it hasn't been necessary to use any compound but water, and it may never be. But if the time comes that we need another source, it will be simple to change our supply."

For a long time the Earthman was silent. His eyes watched the steady flow of water beneath the visi-plate, but the sight did not register in his brain. His mind was back in the laboratories at home, where science had struggled for years with the problem which these people had solved. What a boon it would be when he could explain what he had learned.

During the following weeks, Jack spent most of his time familiarizing himself with the various machinery. Storic Polloy was a willing instructor whenever he discovered something beyond his understanding.

The voyage had grown tiresome by the time Polloy announced that they were nearing their destination. Being shut below the surface of the water for such a long period had weakened the three people considerably.

The two men had been watching Mordin with great concern. She had not been feeling well for several weeks and spent most of her time in her room. Her first spontaneous smile came with news of the end of the voyage.

The spirits of the three people brightened and they laughed and joked. Jack anxiously awaited a glimpse of the land ahead which Mordin had described in such glowing terms.

His treatment as a native Roonerion, rather than a guest on board the huge ship, puzzled the Earthman. He had gradually acquired duties and relieved the older man of many arduous tasks. He even stood watch in the control room for short periods, while Storic slept.

The change from the status of guest,

to belonging among these people as one of themselves had been so gradual that Bissler hadn't realized what was happening. He had assumed the position of assistant to Polloy, had entered all conversation in connection with operation of the ship without knowing when or how it had taken place.

Many times the golden people came to him for advice, before some change in the general program on board the Roonamere. They even seemed to give his advice great weight, especially the golden man, as if Bissler were some one of power. But Jack ceased to ask about anything beyond their immediate future as the subject was avoided by both man and girl.

When Polloy slowed the ship considerably, several hours before they were due in port, he explained that they must pass through a narrow tunnel for a long distance.

The ship only moved at intervals for a while. Conditions were not right to enter the narrow passage. The golden man was holding the ship against the current, waiting for the change of the tide.

At last it slid within and Jack saw that they had entered a stone tunnel only slightly larger than the Roonamere. The walls were worn to smooth rock from the wash of water through ages.

Jack stood in the control room for the last part of the trip, watching every movement carefully. Several times the huge ship rubbed against the stone sides when rounding a slight curve, but Polloy handled it skillfully.

When they had been within the passage for more than an hour, the ship began to pick up speed and the stone slid by faster and faster. The motor was only used for occasional blasts, to keep the ship in the center of the tunnel. But the current was pushing them through.

The golden man was watching the instruments intently and suddenly he started the blasts again. But this time they pushed the ship back against the water and slowed it in the tunnel. A moment later the water outside the hull became lighter. They were sailing just beneath the surface of smooth, open water. The moment they passed beyond the end of the tunnel, Storic Polloy shut down the blasts and they now sailed with the momentum from the passage.

It was daylight above the surface. From the amount of light which penetrated to their level, Jack knew they could not be far beneath the surface.

SEVERAL HOURS passed before the ship neared port. Slowly an expression of surprise had crept over the features of the golden man and girl. They had been watching hour after hour through the front visi-plate, as if expecting to meet other shipping. But there had been no sign of life in the clear water.

Several times the remarks that passed between Storic and Mordin puzzled the Earthman, but he was not taken into their confidence. They seemed worried that they were unable to detect any other shipping.

"It is very strange, Mordin. We should have sighted many craft before this. Yet not a single gauge has registered the slightest tremor. The water seems empty. There is only one thing that can explain it, and that seems impossible. It *is* impossible and yet—— There has been no trouble among our people for many centuries."

As Storic finished speaking, his attention returned to the empty water ahead, while Mordin watched the gauges. A silence settled over the little party, seemed to create a ghost ship of the Roonamere. It grew worse as time

passed, until even Bissler felt the nervous tension.

The ship had been creeping along for an hour before the silence was broken by the girl.

"I know what you meant, Storic. We hardly dare go into port. We have been away for so long, that many things may have happened, of which we know nothing. No matter what has taken place, the tunnel would be left open for the safety of the race.

"After dark we had better go to the surface and see if there is any sign of lights from Roonera. We are close enough so the glow over the city would be quite plain. Perhaps this trip was a mistake. Our people were left alone to seek whatever quarrel they might."

Jack stopped trying to understand their conversation. They didn't want to explain their worries and it was giving him a headache to follow the trend of their thoughts.

Soon after dark the ship came to the surface and the three people stepped out on a small, flat, top-deck. After breathing the artificial air of the ship for so many weeks, they could almost taste the freshness of the cool night air.

There was silence, while the golden man and girl gazed into the distance. At last they turned away without speaking, but Mordin sighed audibly. There was no sign of glow where they had expected it.

The Earthman gazed at the stars gratefully. They reminded him of home and all that was left behind. He wondered if he would ever see the familiar countryside where he grew up, but he drove the thoughts from his mind. In the distance, a range of mountains blotted out all else. When Jack realized their great height, he was filled with awe. It seemed impossible that such huge things could exist in the world he had always known, and yet there be no mention of them in any textbooks. They dwarfed even the greatest mountains in the known world.

Following the range with his eyes, he found that they stretched nearly all the way around the horizon. Even at the point farthest from where the ship lay, they were high. There could be little difference in their actual height; only distance gave the different impression.

THE SHIP was in an inland pocket, buried in the range of super mountains. It was no wonder that the rest of the world had never learned of the existence of this golden race of people. They were as isolated as if on a separate planet.

When the thought struck Bissler that they had been traveling at a fair speed for many hours and still the mountains appeared high in every direction, their magnitude was beyond his grasp. They were beyond the possibility of scaling.

Suddenly the little party stiffened. The golden man jumped to his feet and a cry of gladness came from his lips!

A moment later it changed to one of consternation. He seemed to shrivel and draw back within himself. Then he hurried the others within the hull of the ship and slammed the hatch shut behind.

When he handed a life preserver of odd design to Mordin she didn't speak, but the color drained slowly from her face. The Earthman reached to support her as she stumbled.

As the golden people fitted their life preservers on, Jack followed suit. But it was beyond his understanding. Even their remarks were unintelligible. But he knew they were in danger from some source. He listened to everything the man and girl said in the hope they would solve the riddle.

"I'm sorry, Mordin, but it may be only a scare. I want to be prepared for anything. There is no glow from the city and there has been no sign of

any craft. Yet I distinctly heard the throb of some ship that was invisible in the dark—and it did not sound like a Roonerion vessel.

"The fact that it is traveling without lights is not very reassuring, but it may be one of our own. If you should fall into the hands of Salika, it would surely mean trouble."

When they reached the control room, the gauges registered the location of a large ship. After watching them for a moment, Storic seemed to give up all hope and slumped down in the pilot seat.

"I don't dare sink below the surface. This ship was not built to withstand a blast. It might withstand an ordinary collision, but not the blast from a bomb. Beneath the surface we would be doomed the minute we were hit."

"No, Storic. It is better to take the chance of being able to outrun a battleship, than to simply sit here and wait for some one to blow us up. I know that we can escape at the surface with our belts, but there is a good chance with the life-ship when we are beneath.

"I would prefer to die on board than be taken prisoner by the Salikans. They would pick us up the minute we appeared in the water. The small ship can carry us far enough so they will never find us, or else we can reach the port at Roonera."

IV.

IT SEEMED as if the girl's words were orders rather than a suggestion, and a moment later Storic dove the huge ship beneath the surface at full power, without waiting to sink. Mordin and Jack held tight to braces on the wall to keep from being thrown from their feet. Storic Polloy was held tight in the pilot's seat.

The depth gauge kept swinging around until it showed a much higher reading than at any time during the trip, and still Polloy was not satisfied. When the gauge began to waver and hesitate, he leveled off and darted the ship first one way and then another.

Twice the throb of heavy vibration shook the metal of the ship and Jack glanced at the golden man questioningly.

"Yes, Ormoly. That was a depth bomb, and too close to feel very comfortable. They are after this ship without trying to communicate with us. They must be certain that it is not one of their own ships. We have a different vibration than any other vessel in the sea and it is possible that they are particularly anxious to do away with us. Our return will not be very welcome to the Salikans, if they have learned of this voyage."

"Do you think they will hit us?" Mordin asked after a moment.

"I don't know, child. It is the chance we must take, if we stay below the surface. I wish that you and Ormoly would get the safety-ship ready. We will not have much time for escape, if we're hit. This ship will fill with water in a few minutes."

Five minutes later, Mordin led Jack into a sealed chamber directly behind the opening to the top-deck. The heavy panel slid back with difficulty, to expose the opening beyond. Mordin immediately started to remove a small plate on the side of the miniature ship in the heavily built room.

It was similar to the Roonamere except that it was much shorter in proportion to the diameter. The room was not over thirty feet long and the small ship did not fill it entirely. As Jack examined it, he realized it would be cramped quarters for any extended voyage.

It was about twenty-seven feet in length by twelve in diameter. The shape would tend to imply a much slower speed than the big ship was capable of, but it looked to be seaworthy. He was

still trying to find some way to remove it from the room when Mordin called.

"Ormoly! I need you to help open this port. I've got it unfastened, but it sticks in place. I want to be sure there are sufficient supplies to last several days."

As they crawled through the small opening, Mordin switched on the lights.

There was comfort on board, even if the ship was small. The port opened into a cabin in the center of the ship, with bunks built on one wall. A couch against the opposite side, next to the port, a table and two chairs completed the furnishings. Everything appeared to be in perfect condition, but there were only accommodations for two people. Mordin explained when Jack inquired.

"They only prepared for Storic and me, but this ship can carry twenty men in an emergency. There is ample power, although it would be close quarters."

There was just room for two people to squeeze into the small pilot room, ahead of the cabin. The control board had the same important levers and gauges as the large ship. The Earthman knew he could handle it without difficulty—if necessary.

At the back end of the cabin a small kitchen, well supplied with food, drew Mordin's attention. She examined every article before turning away.

As they climbed out through the port hole, another shock was felt through the giant hull, and the Roonamere rolled several degrees to the side. The bomb was much closer this time; the next one might hit.

As they hurried back to the pilot room, Jack had a brilliant idea. A moment later he explained to the golden people, while they listened carefully.

"I don't see any reason why we should stay with this ship until they hit it. If we can set the controls so it will keep dodging for several hours, then have the automatic pilot take it into port, it will do as much good as if we remained here.

"If they miss it, it will reach port safety. If it should be hit, there is nothing lost and we will be safe at sea. I have learned enough about this ship to realize that it will only take a few minutes to time every action, so it can go on the same way you have been handling it. What do you think?"

Storic Polloy was surprised at the suggestion of the Earthman, but he grasped the whole idea. Instead of answering he started to work on the control board. While he worked, he talked.

"You must have wondered, Ormoly, why I didn't signal our country by radio, but I dare not do it. If it was known that Mordin and you were on board this ship, we would never reach port. The Salikans would blast us out of the water with every bomb they own.

"You have been patient, waiting for an explanation of our actions. But it will not be long after we reach Roonera before everything can be explained. If you will wait a little longer, you will understand everything."

TIME seemed to drag while the timing devices were set in place and hooked to the controls. Twice more the ship rolled from a near-by bomb before they finished the final examination and headed for the safety-ship in the top of the huge hull.

When they entered the heavy room, Storic closed the panel behind them. Then, after sealing the port to the small ship, he entered the pilot room.

Jack was still wondering how they were going to plow their way through the side of the giant hull when the golden man explained.

"This chamber is water-tight and will not allow seepage into the rest of the Roonamere. When I create enough gas pressure inside this chamber, it will break the seal on the plate overhead.

When the gas pressure decreases through the opening, water will enter to fill the space around us. Then we will be floating in the same pressure as the sea outside, except that the plate will remain nearly in position.

"At that time we can rise in the water and push the plate out of the way. The main danger will come when we are tossed away from the big hull, as it is traveling at high speed—much faster than this small ship can possibly go. But it gives us one great advantage. The Salikans will never think that we have deserted the big ship while it is traveling at such speed."

While Storic explained, his fingers had been running over the miniature keyboard. Gas had been filling the chamber until it created pressure enough to register the same depth on the instruments as that recorded in the Roonamere. Suddenly a splash of water landed on the hull, to be followed by a steady stream.

Through the front visi-plate, the water level could be seen as it rose steadily, until it was above their heads. For several minutes longer the small ship lay still, to make sure the chamber was entirely filled. Then Storic moved a lever slightly.

Slowly the small ship lifted from the floor, as gas bubbles rose around the sides. A slight jar announced that they had touched the plate above. As the tubes were turned on full, blasting every ounce of power against the floor of the room, the ship fought against the overhead weight.

As it slowly raised the heavy plate, Storic turned to the others. "Fasten the belt around me, then hold onto anything that you can. We will be free in a minute and tossed around like a hubble in the water. It will be a wonder if the ship holds together."

Jack fastened the belt, then tucked Mordin into one of the bunks, with her hands on the upright braces. Before he could climb into the one above, the ship twisted and threw him across the room.

As his senses faded he was thrown back again. He gripped the metal upright beside the bunks with every ounce of strength. As the room turned black, he felt small hands draw him into the bunk and help hold him in place.

WHEN he returned to consciousness, Mordin was bathing his head. His hands were still locked tight to the metal bar at the end of the bunk. When his eyes opened, the worry faded from the faces of the golden man and girl. Then Storic worked his fingers loose from the bar and moved him into a comfortable position.

The ship had escaped without damage, but Jack was hanged up from being thrown around the cabin. His right eye was swollen shut and he had a lump the size of an egg behind his left ear.

Storic was smiling now. "You are a strong man, Ormoly. I could not loosen your fingers from that upright with every ounce of my strength. You certainly held on to stay."

When Jack lifted his hand to feel of the swollen eye, the others laughed. They had escaped with no serious injury. The small ship was headed for port under the automatic pilot. The strain of the last few hours was gone and they were almost happy again.

Bissler was so lame that he didn't try to get out of the bunk, but was perfectly willing to let Mordin play nurse and wait on him. But Storic only let him rest a short time before he found some task for him.

They waited for daylight before entering the port of Roonera, so there could be no mistake in their identity. They dared not announce their arrival to the Roonerions, by radio, for fear it would be picked up by Salika and they would be hunted down.

Only the fact that the Salikans were so interested in sinking the Roonamere

kept them from discovering the small ship, traveling in a different direction. All of their instruments were focused on the huge hull to try and forestall its movements.

The fear of capture left the small party as they passed beyond the danger zone and Polloy headed toward an uninhabited section of coast to wait for daylight. There was little chance of meeting an enemy in that section, and yet they were within a few hours' travel of Roonera.

The night passed slowly, with the small ship lying a short distance from shore. Twice they opened the upper hatch and looked longingly at the thick foliage reaching to the water's edge. Sleep was impossible. The cool night air was refreshing and made the events of the last few hours seem far away.

With the first tint of pink in the sky, the hatch was fastened down and Storic sank several *tols* beneath the surface. Then they headed leisurely toward port.

Twice the blasts were shut down, when the instruments registered metal a short distance away. The ship was allowed to roll with the current, as if it were some sunken wreckage, until the big ship moved away from that section.

The first time they stopped, the large ship circled several times before going on. But the second ship hailed them.

Their hearts stopped beating as the radio spoke. "Answer, if you are ship of the sea. This is Cruiser Bolk calling, Commander Hoykij in charge. Answer, or I drop a bomb to make sure you are not alive."

"That is a Salikan ship!" At Polloy's whispered words, their hearts almost stopped beating and they waited for the blast.

Then they faintly heard a voice, not addressed to them. "Don't waste a bomb. It is too small to be a ship. It is more likely an unexploded mine, planted by the Roonerians. It might blow *us* out of the water! Go back to your course. We are——"

Three sighs were audible in the small ship, as the words ended in a broken sentence. They had escaped by a very slim margin. Now they were certain that the two countries were at war and the Salikans seemed to control the sea.

It was midafternoon when the safety-ship reached the harbor of the city. Storic had taken plenty of time, to avoid detection of their movement from a distance. They were still well below the surface and too deep to be seen from above.

As they passed within the harbor, Polloy shut off the blasts and let the ship drift with momentum. The gas bubbles at the surface would tell a story that any sailor could read.

When they had drifted as far as the ship would go without power, he rose to the surface. The ship was still for a few moments after it broke water, then the hatch lifted and the golden man peered out. The two younger people watched as Storic pushed his head through the opening. Suddenly Mordin screamed! Storic's feet had disappeared through the opening as if by magic, he had been jerked outside, by some one above!

A small ball of glasslike appearance burst as it touched the floor beside them. The Earthman watched, fascinated, as a greenish vapor spread over the metal floor——

WHEN JACK BISSLER regained his senses, he was strapped on a rough couch. As his eyes wandered around the walls and ceiling, he knew it was the same type of ship as the Roonamere, but lacked the finish and comfort of the other ship. He was in one of the small cabins. His examination was disturbed by a voice, addressed to him.

"Who are you, with the strange skin and eyes? I have waited long to question you. You must answer quickly."

As Jack twisted his head to meet the eyes of his captor, he received a shock. He was a member of the same race as Mordin and Storic, but showed none of their refinement. His eyes were hard and cruel, without sign of human sentiment.

When Jack replied in English, the man lost his temper. He tramped back and forth several times before facing the Earthman again.

"It seems impossible that you speak a different language, but it may be so. We shall find out shortly. Whether you speak my tongue or not, you can understand a little rough treatment. If you decide to talk in Roonerion, it will be stopped. But if you continue the same meaningless chatter, we can't even tell that you are being hurt. Perhaps you will discover how to speak my language in a hurry."

While the man raved, Jack's eyes kept turning toward a blunt object at his side. The Earthman recognized it as some kind of gun. He'd give a lot to have it in his hands and know how it worked.

As the man turned away for a moment, Jack strained at his bonds. To his amazement they snapped without much effort and freed his arms. One healthy tug at the straps holding his legs and they were parted as well.

When the golden man turned to face his prisoner again, his mouth dropped open with astonishment. The man was sitting on the couch, facing him!

As he started to give an alarm, Bissler's fingers closed around the greenish throat and sealed the sound within.

To Jack's amazement, the man was no stronger than a small child. He held him easily with one arm, while he removed his gun belt. The golden man was just as amazed at the Earthman's strength and didn't try to struggle in the iron grip.

It only required a moment to tie him up with his gun belt and shoulder straps. Some upholstery ripped from the couch, stopped any noise from escaping from his mouth. Then strapping him down with the same straps that had held himself a few moments before, Jack was ready to travel.

He was in a strange ship, in a strange land, facing a strange enemy, but he wanted to fight. Somewhere, they were holding Mordin and Storic prisoners. If he could free them, he knew everything would turn out all right.

The gun felt odd in his hand and he tried it at a chair across the room.

When he moved the lever on the side, there was no sound of explosion, but a small hole appeared in the upholstery of his target. At least it worked, even if it didn't make any satisfying noise.

Gun in hand, he stepped in front of the largest panel. As it opened he peered into the passageway beyond.

Hearing voices from one direction, he turned the opposite way. He wanted time to explore the ship before they discovered his escape.

This ship was even larger than the Roonamere and built of much heavier metal. There was no mistaking it for a passanger ship, after seeing gun-ports on every side.

V.

WHEN Jack reached the stairway to the upper deck, he turned that way. There had been no sign of men in the passageways; they seemed to feel perfectly safe without guards.

As he stepped from the hatch, a man turned to face him. It was too dark to see that Jack was not of his own race and the guard simply inquired his business.

The man noticed the gun in Jack's hand before he had time to answer. A pencil of light reached out and the Salikan crumpled to the deck—with his gun half way out of the belt.

Bissler felt sick at sight of the form

in front of him, but conquered the feeling to look around the harbor. There were over a hundred of the huge ships with their rounded backs above the surface of the water. Guards were faintly visible on the nearest decks and one of them hailed him.

"What's going on? I saw the flash of a gun. Is there trouble on board?"

Jack was quick to answer. "No—nothing. My gun has bothered lately and I was testing it. The commander gave me permission to fire into the water while I'm on watch."

This seemed to satisfy the other man. He continued his pacing on the small deck.

The city appeared to be in control of Salika and Jack's heart sank at sight of the warships. He wondered if there were any Roonerions left in the city—then his attention focused over a section of the city far from the water front.

At uneven intervals, flashes of light appeared over that quarter, but there was no sound. Then the Earthman remembered that their weapons were silent. The only way of knowing they were fired was by the flash of light.

From the brilliance of the flashes, they were using heavy guns. The fire from side arms wouldn't be visible at that distance.

The man on the deck was beyond help, so he left the body where it had fallen, after removing the gun. As he turned toward the hatch, a man's head appeared in the opening.

Jack walked toward him instead of speaking. Before the fellow knew what had happened Bissler hit him with a gun butt. As his form sagged, the Earthman drew him out of the opening and left him beside the dead man on the deck.

The most likely place to find Mordin, he decided, was in the main cabin. Jack knew that she was a person of importance and the Salikans would treat her with respect. If Storic Polloy was with her, they might escape together.

Twice, on the way through the ship, Jack met men unexpectedly. But when they looked into the business end of the guns in Bissler's hands, they surrendered without a struggle.

Jack found a room on the upper level where the panel could be fastened and locked them inside. The walls were so heavy that their shouts could be heard only faintly from the outside.

He heard voices as he approached the main cabin. When he saw no one, he stepped cautiously through the doorway. The back of a man blocked the door to one of the rooms at the side and Mordin's voice came from beyond.

"I don't care what you threaten, I want you to free the man who was with us. He doesn't mix in our trouble and will be harmless to Salika. I admit that you've captured the harbor and silenced the shore batteries, but there are many Roonerions still able to fight.

"Even if you capture the city of Roonera and destroy every inhabitant, the war will not be over. You hold Storic Polloy and me prisoners, can bargain for our freedom. But you have no right to hold the stranger. He should be turned over to Roonerion. We brought him back from our trip and injury to him may lead to trouble with his race."

JACK had been creeping closer to the doorway, while Mordin talked. As he appeared behind the man, surprise registered in the eyes of the girl and the Salikan officer whirled to meet the Earthman's charge.

Jack's fist drove him across the room, to lie where he had fallen. When he crumpled up as if hit by a sledge hammer, Bissler knew it would be a long time before he would be interested in his surroundings again. These people were very sensitive, and the Earthman wondered if he had killed him with the blow.

Surprise had sealed the lips of the two

people, but now Mordin ran forward with a cry of gladness. Storic started forward with a question, but Jack didn't give him time to speak.

"We must hurry, if we are to escape. They are fighting in a far section of the city, but everything near here is under the control of the Salikans. I have locked up two men, tied up another, knocked this man and one other out, and killed one man. How many are there on board?"

"Why! Why—I don't know exactly," Storic was slow to answer. "But there can't be many. Most of the men are in the city, fighting."

Handing Storic his extra gun and giving Mordin the gun from the man on the floor, Jack turned to leave the room. Mordin held tight to his hand as she looked at him in wonder. He had almost captured the battleship alone.

They found three men asleep in their quarters and locked them in with the other prisoners. The officer that Jack had knocked out was unceremoniously dumped in with them. The unconscious man from the upper deck was next. When the one that had been left strapped to the couch was brought up, they had the ship to themselves.

The golden man and girl were too stunned to question the actions of the Earthman, and simply followed where he led.

When he closed and fastened the top port, they just stared. Then without a word they followed him down to the control room, where he turned to Storic.

"Sink the ship a bit, will you? This tub should handle as easily as the Roonamere, but I'd rather you did it. I want to leave in the life-ship. We may be able to reach shore in that, where we couldn't escape any other way."

Ten minutes later Storic started for the room housing the small ship, while Jack and Mordin remained in the control cabin.

When they rejoined Storic at the life-ship, Mordin was laughing so hard that tears rolled down her face. It puzzled the old man to see her laugh at a time like that and he tried to appear very stern.

Before they closed the panel so the small ship could escape, Jack went back to the room where the men were held prisoner. He silently unfastened the lock, so they could walk out as soon as they discovered it. In the meantime, they would think they were still locked inside.

It only required a moment to build up pressure to free the small ship in the shallow water. As they headed for shore beneath the keels of the battleships, Storic became still more amazed at the orders he received from Ormoly. But they started Mordin laughing again.

"No! Don't be careful of the blasts. Turn them on all the way and circle the harbor several times. There is no danger of their trying to bomb us, for fear of damage to their own ships.

"Travel back and forth, so the bubbles will rise around as many ships as possible. I want them to think a whole fleet of ships is running around loose."

For fifteen minutes the small ship circled beneath the huge battleships. Then Jack gave the order to head for shore, and shut off the blasts.

When the small ship rose to the surface underneath a big wharf, the harbor was alive with shouting men. Ships were hailing each other to find out what the disturbance was.

SUDDENLY there was a scream from the deck of one of the boats as it rose high in the water. Then it rolled to the side, dumping the watchman into the sea. Another ship appeared beside it and started off at terrific speed. It acted as if the men in control were out of their minds.

Tearing through the water at full speed, it hit one of the other ships in the

side. The prow was built for ramming and the other ship sank lower in the water, while men appeared on the top-deck to keep from drowning. The huge ship broke free and started off across the harbor again.

For ten minutes the giant ship tore around the water in circles, while the men on the other ships tried to decide what to do. It was recognized as their flagship and they dared not fire at it. Suddenly the gun ports of the runaway ship started belching fire, and the ships it passed disappeared as if by magic.

Storic Polloy watched, fascinated, as the havoc was wrought among the enemy ships. When he found his voice, he spoke more to himself than to the others.

"You certainly deserve the right to the name Ormoly. I have never seen anything like it. To use *their own* flagship—to sink their own fleet! I wondered what Mordin was laughing about when you came up from the pilot room. Now I understand. You set and locked their controls, timing them for every action. The men on board have probably been trying to get into the pilot room ever since it started into action.

"You man, you have earned the gratitude of every Roonerion. They will never forget—and neither will the Salikans! It is marvelous!"

The giant ship had calmed down now. The gun ports no longer belched death at everything around them. The ships still afloat were picking up the survivors from the sunken hulls. A few minutes' work had accomplished more than a terrific sea battle! The fleet was completely demoralized.

The three people listened intently to the sound of running feet overhead. Men were pouring onto the pier from every direction and shouting to men on board the ships. Suddenly Storic turned to the others.

"They have stopped fighting and are being driven back by the Roonerions! They heard that the fleet was attacked and came back to protect their ships!"

Before Storic finished speaking another commotion started out in the harbor. This time flashes of gunfire came from every direction. The men on board the ships were almost hysterical, fired at the new menace as fast as they could.

Another ship was sailing up the harbor, as unconcerned as if it were in the open sea. The shots fired at it hit other ships as often as they touched the newcomer. There was no sign of return fire from the strange ship. The three people puzzled as to who it could be that would sail through the enemy fleet without fighting.

Half the Salikan fleet was on the bottom of the harbor before order was restored. Now the Roonerions were hammering at the back of the demoralized Salikan troops. The enemy was caught in a tough spot. The sea ahead seemed the safest and they began to jump into the water and swim toward their ships. Anything was better than staying to be annihilated by the Roonerions.

A FEW MINUTES later the heavy shore batteries began firing at the remaining ships. The Salikans hadn't bothered to destroy them, after capturing them through a coup. Now they were turned against the enemy for the first time and caused terrible havoc.

As the remains of the ship which had sailed so unconcerned up the harbor floated by them, Jack exclaimed aloud. "Why! It's the Roonamere! It must have just arrived under the automatic pilot and sailed right through their fleet. If they had found out what they were fighting, it would have been just too bad. But it's a shame that ship had to be destroyed."

Small lifeboats were drawing up to the pier to carry men on board the ships when the shore batteries went into action. Now they besitated. The bat-

tleships made perfect targets, and were being sunk faster than they could be counted. There was no place for them to go.

Suddenly a flare went up from the flagship. The firing ceased. Even the voices on the pier above seemed relieved. When the sound of fighting from the shore died down, a deathly calm settled over the harbor.

Two hours later the Salikans had been disarmed. All the ships in the harbor were under the control of the Roonerions. The three people had not moved, for fear of the wrath of the Salikans. In less than four hours the tide of battle had changed, to become an overwhelming victory for the Roonerions.

The great pier under which the small ship floated was the meeting place of the two commanders. The officer Jack had knocked out with his fist came ashore in a small boat. He still acted groggy from the blow and his chin was swollen where it had connected with Bissler's wallop.

The harbor was brightly lighted now, but there was still dense shadow underneath the wharf. Mordin had been enjoying the change of events so much that she would not let Storic announce their presence after it was perfectly safe. Now she let him move the small ship out of their shelter and draw up to the landing dock.

No one had an inkling that they had been hidden beneath the feet of an army. Now every eye turned toward them as tbey came into sight.

When Mordin stepped from the deck of the small ship, the commanding Roonerion officer stepped forward to be sure he was not mistaken in her identity, then he fell to his knees before her. Word spread like magic among the men and the army fell to its knees.

She held Jack by the hand as she approached the little group of officers. Storic followed a few feet behind. When she was within a few steps of them, she spoke. "Men of Roonerion, I bring you a man whom you can admire. He has destroyed half the fleet of Salika without the loss of a single Roonerion life. It was he who turned their own flagship loose, to ram their own vessels. It was he who freed both Storic Polloy and myself from our captors. It was he who planned our escape when the Roonamere was being bombed by one of the Salikan ships.

"Men of Roonerion, I bring you a great man, a great fighter, and a great leader!" For a moment she hesitated, and her next words acted like magic.

"People of Roonerion, I bring you ORMOLY!"

For a moment there was silence. Then a shout rose from the crowd. From the little party it went in ever-increasing volume to echo through the streets of the great city. From a war-torn country, Roonerion had changed to a happy, celebrating nation.

Jack Bissler was in a peculiar spot. He knew that Mordin had made him the hero of the hour, but the men seemed to almost *worship* him. When Mordin announced that she had brought back "Ormoly," they had gone wild with joy. Yet he was called Ormoly before he had even seen the city of Roonera.

VI.

THREE HOURS later, Storic Polloy ushered Bissler into a great gathering hall—tbree hours packed with more excitement tban Jack had thought possible.

From the time they left the dock, Jack hadn't seen Mordin. He wondered if she would be kept away from him now that she was in her home city.

When they left the dock, they were whisked across the city in a car driven by a maniac. Jack was certain they would never reach the end of the trip alive, but Storic appeared unconcerned.

The car had the general appearance of an automobile, but was streamlined to appear like the underwater ships. The body was hung between giant wheels that reached above the top of the sedan-roof. He decided that the constant roar was not from the motor, but was a siren that cleared the street ahead of them.

Twice they stopped for a slight traffic jam and the car slowed up so abruptly that the Earthman found himself on the floor—to the amusement of Storic Polloy. The crazy rush seemed foolish. They didn't appear to have time to think in this city, yet other vehicles were not tearing along at such terrific speed.

When they drew up before a beautiful structure, Storic hurried him to an apartment with luxurious furnishings. Even here Jack was not allowed to hesitate, but was hurried into a bath by men who awaited his arrival. He was dressed in a garment of exquisite workmanship and ushered out again to where Storic waited.

Several times the Earthman thought of questioning the men who were waiting on him, but decided to wait and see what came next. They might not understand and think it odd for him to ask. Twice, when he mentioned some slight desire, the men fell over themselves in their anxiety to satisfy his whim.

As Jack walked slowly up the aisle beside Storic, he felt a qualm of misgiving. Polloy was walking in measured tread, with great dignity. Six men sat upon a raised platform at the other end of the room awaiting their approach.

When the golden man left him at the edge of the platform and occupied the seventh chair, the Earthman felt his knees weaken. He knew instinctively that he stood before men who controlled the destiny of Roonerion.

Minutes passed, while he faced the unwavering eyes of the seven men. Even Storic Polloy seemed to lack all the friendliness of their long voyage. Twice a lump rose in Bissler's throat. He swallowed hard to hide his embarrassment.

The oldest man, seated slightly ahead of the others, broke the silence at last.

"Storic Polloy! You have been chosen to explain to us and to enlighten the stranger upon his position in Roonerion. You are best fitted to speak to him. We will be satisfied with a very short summary of events leading up to this moment. We already know the purpose of the voyage, why it was necessary.

"Mordin has been before us, in your absence, and we accept him for Ormoly without further question. She persuaded us that no fitter man could be found. Storic Polloy, proceed with your duty!"

It only required a few moments to relate the events that Jack remembered—from the time the light first appeared in the water. He didn't listen, until one sentence in the narrative struck him like a blow, and he staggered back!

"As Ormoly was reduced to a proportionate size with our own——"

BISSLER heard no more of Polloy's explanation. His head was swimming with the sudden revelation. He should have guessed—yet he had never realized the truth! It had been impossible for him to imagine that *he* was reduced in size. Instead he had thought that the ship and golden people were *enlarged!*

What a fool he had been. The simplest answer was the one that hadn't entered his mind. Slowly Polloy's words seeped back into his brain. He followed his remarks again.

"He locked the controls of the Salikan flagship, and started the trouble in the harbor, which ended in our complete victory."

As Storic finished speaking, he

turned toward the Earthman as if the other men were no longer in the room.

"Ormoly! I hold great affection for you—much greater than you have ever known. It would have been improper for me to reveal it before this moment.

"I must go back into history, to explain many of the events that have taken place. It is necessary, that you may understand why I came for you in the Roonamere. Yes, that trip was planned. Mordin and I came for the sole purpose of bringing you back to Roonerion with us.

"I am one member of the Goran. The other men before you are the other six members. We have ruled Roonerion for twelve years, since the death of our born ruler. He left only a daughter to succeed him, and a girl has no right to take over her position until she has mated.

"For many centuries our mates have not been chosen simply by the natural attraction between sexes. We are able to test the vibrations of two individuals and tell beforehand whether they will live happily together. Since this system was put into practice, an unhappy mating is almost unknown.

"When our ward came of age for mating, we searched the nation for a man who matched her vibration—and in all the millions of inhabitants there was not a single man who could fill the required place. After finding a suitable mate, it would be up to them as to whether their physical attraction was sufficient to create the remainder of the bond.

"We have a machine which is sensitive to our mental action, and which can accomplish this purpose. When two vibrations of a like order are in contact, it registers the result. Of course, we are more selective with the ruler of the nation than we would be with any subject.

"Roonerion is the only nation which brings together people of like vibration. The Salikans desired an alliance between the two ruling houses when they found that we did not have a selected mate. Our refusal led to the war. Salika attacked during our absence in the Roonamere.

"Our race of people has not always been small, but was once your former size. In ancient times we lived in the outside world. It has been so long that no record of actual conditions in that life remains. When an age of ice approached, our ancestors made use of a principle discovered by their advanced science.

"This island sea was prepared, with room for expansion of the miniature race. A solid sheet of clear material covered this world, but has since disintegrated. The small channel was cut through the rock wall, to allow escape

for any surplus water which might drain here in heavy storms. We were protected from all the effects of the ice.

"As many of the inhabitants as desired were reduced in size, placed in this miniature paradise. The big race could prepare for miniature people, where they could not build for themselves. They reduced every kind of vegetation and animal life. Life was little different after the change in size.

"There were many who did not want to be reduced, but stayed in the outer world to await annihilation by the cold. Until a few centuries ago we didn't know that any of them had escaped. They must have been the progenitors of your race.

"Whether your skin and eyes have changed through the ages, or whether it is our own, we do not know. But we believe that we both came from the same original stock. The process which was used for reducing our stature has been kept intact from the time it was first used, and we decided to make use of it to secure a mate for our ruler.

"After much testing throughout your race of people, you were selected as the individual to be reduced and brought back to Roonerion. It required over a year to search out your vibration. Naturally, we could not see you any more than you could see our ship.

"The Roonamere was more than a test ship; it contained the equipment for reducing your size. By having Mordin on board, I was able to search out the individual vibration that matched hers.

"For several months before you finally sought us out we had been trying to impress on your mind the necessity for seeking the seashore. You didn't know the reason for coming to the shore, but it was due to mental suggestion from Mordin and me. Even then, we had to wait for very calm water before we could approach the shore.

"As you must realize by this time, Mordin is the born ruler of Roonerion, and you were selected as her mate. That gives you the title of Ormoly, the most powerful word in all our language. The rule of the country actually lies in your hands, although you inherit it through mating.

"What I have been telling you will explain your strong attraction for Mordin. The one thing I was worried about was your physical appearance. But the way Mordin held your hand told me more than anything else possibly could.

"We have taken away your world without your permission. There is no return to the large stature, although you have retained some of the superstrength. In place of what we have taken away from you, we are offering the highest possible position in our nation—if you will accept it. Mordin is more than willing to take you for her mate. We are waiting for your answer!"

FOR a long time the Earthman stood silently before the seven old men. The world had been swimming in circles for the last few minutes and it was hard to realize his position. He, Jack Bissler, was offered the highest position they could offer. And they were asking him to take the most beautiful girl he had ever seen for his wife—and questioned whether he would do it!

But *was* she such a beautiful girl? Perhaps it was simply that their vibrations were in accord. But to *him* she was beautiful. That was all that mattered. At last he found his voice.

"Gentlemen, you are asking me an odd question. I would give up everything else in life for the opportunity of mating with Mordin. All the power and position that you offer is of little account in comparison to my affection for her. Certainly I accept, and am grateful for the opportunity!"

For a moment Jack thought he saw fleeting smiles pass over the features of

the dignified men—but he could not be certain.

Suddenly the room filled with voices, and he swung around to see the great panels at the other end of the hall slide open. It was not long before every seat was filled with the smiling, laughing throng. This was not a solemn occasion, but one for rejoicing.

Two great chairs were wheeled to the center of the platform. Jack was invited to occupy the one on the right. He was facing an audience that smiled at him with clearly evident pleasure and respect.

When a panel swung open at the far side of the platform, Mordin came forth alone. The voices hushed as she strode toward Ormoly. As she mounted the great chair, her eyes did not leave the face of her mate.

At a given signal, music filled the hall, to blend with the shouts of the people.

Suddenly the Earthman jumped down from his seat and walked to the side of Mordin's chair. *They* might have finished *their* ceremonies, but there was one thing he had wanted to do ever since he had known the golden girl.

A moment later she was in his arms, for the first kiss in Roonerion history—and Mordin liked it!

The Voice Out Of Space

by Clifton B. Kruse

Suggesting that the real space-traveller is not a body but——

"OXYGEN!" Dr. Frick's voice rang thinly in the earphones. "We are rising again, Tom. At camera, quick. But first give us both more oxygen."

Tom Beckwith got to his feet slowly, his gloved hands clutching the sides of the gondola for support. His brain reeled giddily for a moment and that awful sense of buoyancy caused his seemingly weightless body to tingle. They were spinning now and leaping even higher into the vast, black sky. His fingers trembled as he released more of the precious oxygen into first Frick's, and then his own enormous headgear. His brain cleared instantly. It was like waking from a fitful spell of unremembered dreams.

The rise of the gondola had subsided to no more than a gentle push against their feet. Beckwith stared at the altimeter. Three hundred miles! He wanted to shout at Frick that they had made it, that the helium-radiant stratosphere gondola had accomplished the dream of every solar scientist. Now, Frick was steadying the radiants; for a moment they swayed gently. Telescopic cameras were recording section after section of the yawning cavern of blackness upon which gleamed the jeweled brilliance of billions of stars.

Dr. Frick's voice came into the headphones, heavy with emotion. "It's like being off into space."

Beckwith nodded. Three hundred miles beneath the bulbous mass of the helium-radiant tanks Earth had become a crescent blur of emerald. Directly below was a streak of greenish blue; to the east was the radiant edge of day, while to the west the planet seemed to slumber in a darkness even deeper than the jet of oceanic space.

"It is beautiful," Beckwith murmured. "Below us is night and day. We are seeing the world as no other human eye has ever seen it."

"But look upward—or rather outward I should say," Frick's voice broke into his reverie. "Tom, I tell you I want to go on and on. It's sheer torture to get this far and to know we are chained to that planet down there. Look at the Moon—and over there is Mars, a massive ruby. If only this were a spaceship!"

"Don't dream," Beckwith laughed curtly. "That is not for our generation, Frick."

"You are right—perhaps. But I don't

Frick's eyes blazed with an unnatural brilliance—as if seeing a sight too fantastic for human understanding.

like to think so. The Earth is such an insignificant part of all that lies before our gaze."

"Attention, camera!" Beckwith called warningly. It was a relief to have something to do again. Just to stand here in the gondola waiting for the sensitive recorder to turn through an arc of the sky gave one too much time to dream. He could understand Frick; even a solid, mathematical genius such as Dr. Allison Frick of Erie Planetarium could get to be more poet than scientist out here in space unless he could keep his hands busy.

"It won't be long now. The helium-

radiants have reached their crest. In a few minutes we shall begin to drop. Keep near the oxygen when the time comes."

"Right," Beckwith replied hurriedly. "I'm not worried, Frick. If only we get these pictures back safely our lives will have already been well worth the living."

He had meant to add that he was proud to be here with such a man as Dr. Allison Frick. During the two years since his graduation Tom Beckwith had served as assistant to the great curator at Erie.

"No," Dr. Frick spoke up after a moment of heavy silence. "Not at all finished, Tom. Coming out here has awakened something in me, but—what is that? Did you hear a sound?"

"Yes—and it's not the radiants. At least they seem to be all right."

"Listen!"

Beckwith felt a chill creep through his flesh which even the electro-pads could not check. It was an eerie sound, at first far off but seeming to approach rapidly.

"The radio!" he exclaimed. "It's been silent ever since we passed the ozone layer, but maybe somehow we've disturbed it."

"No, it's not the radio." Dr. Frick spoke excitedly. "I've examined that. Also all our equipment."

"It sounds like—like a voice," Beckwith muttered softly. "Yet not exactly a voice either."

INSTINCTIVELY the two men moved together. They were staring through a porthole of the gondola. Beyond, the heavens seemed cold and black and lifeless. Abruptly Dr. Frick gasped. Within the fraction of a second there materialized a faintly shimmering ball. Cold terror gripped the two scientists. There was no time to speak or even to attempt anything. The weirdly glowing ball was hurtling toward them. Neither breathed for an instant with death so imminent.

Suddenly the gondola was spun crazily, as if some tremendous force were hurling it out into space. Beckwith felt his bulkily garmented body thrashed helplessly about the inclosure. Vividly his mind recorded the impression of frantic, spinning motion. Yet they had not crashed; he was able to understand that much at least.

Dr. Frick was calling his name. The curator's voice seemed barely able to overcome the weird, almost human cries which emanated from they knew not where.

"Meteorite!" Dr. Frick was yelling. "Struck one of the radiants."

"Where are we?" Beckwith questioned fearfully.

"It shoved us farther out into space. We're spiraling now—yes, we're dropping. We've still two radiant tanks supporting us."

"We can reach ground with two," Beckwith called out.

"I know, I know." Dr. Frick was shouting. "But get over here. That meteorite—it's plummeting straight down. The crash broke its velocity."

Beckwith groped to his feet. He was feeling for the oxygen tubes.

"We're dropping plenty fast," he muttered.

"But not too fast." Dr. Frick was once more his old self. "Tom, this makes our trip the perfect adventure. That meteorite—the crash caused it to shriek out——"

Beckwith interrupted: "You mean that queer noise came from it?"

"I'm sure of it. What's more, we must keep its fall plotted. There's something about it—something distinctly unusual. I can't forget the peculiar quality of the sounds it uttered. It was like a voice from the beyond, crying out in awe and wonder."

Beckwith remained silent. He was thinking of the long and treacherous

hours of descent ahead of them. Dr. Frick was excited. Back on Earth again he would be the same, level-headed Dr. Allison Frick who held the admiration and respect of the entire scientific world. The trip out here in space had doubtlessly upset him. Perhaps he had taken too much oxygen.

BECKWITH felt them lifting his body carefully through the safelike door of the gondola. He was too weak to stand on his own legs. Then he heard Dr. Frick's heavy, imperious voice giving orders—telling them what to do and what not to do as they retrieved the precious instruments and the several cameras. Now Frick was bending over him.

"It's all right, Tom," he was saying. "Very little damage done when we hit ground."

"The radiant-lift principle works." Beckwith smiled grimly, conscious of the awed attention of reporters, news cameramen and fellow scientists. "It's the greatest discovery of the twentieth century, Frick, and——"

"Cut it." The elder man's lean face was alight with fiery energy. "And whatever you do, Tom, don't discuss that meteorite yet. I'll explain later. In the meantime I want you to face the public for us. That's your job now."

There was no more time to talk. They had to be heroes, it seemed, but Tom Beckwith cringed inwardly. Now that they were safe and sound on Earth again the adventure didn't seem so great. There was a strange restlessness within which made him impatient to get together with his chief again. There had been something in the gleam of Frick's eyes and the ring of his voice which disturbed him. Obviously Dr. Frick had something in mind. But what was it?

It was not until the next day that Beckwith secured a moment to himself. He sat there in the little office in the planetarium building and pretended to arrange the data of their strato-flight findings. Dr. Frick had mysteriously disappeared.

Suddenly a voice shattered the silence of the room. "I've found it! I've found it."

Beckwith leaped up. Dr. Frick had dashed into the room.

"Where did you go? What——"

Dr. Allison Frick glanced down at his dust-encrusted clothes. A deep-set smile was fixed upon his thin lips.

"I thought you'd know," he said. "As soon as I could get away, I went to the locality where—according to my computations—the meteorite should have fallen."

"Oh, that meteorite!"

"But listen. Remember the queer sounds we heard up there? Tom, I tell you that was no ordinary meteorite. And its striking one of the helium-radiants of our ship was a blessing. That checked its velocity sufficiently to prevent its burning up. Of course, it smashed into the ground. But there was enough of it remaining to indicate that the thing was fabricated."

Beckwith stared at it open-mouthed. "You mean—it was something sent here from some other planet?"

"Exactly. But wait until you see it. It's solid. Not a spaceship, or anything like that. And yet—if I'm correct that mass represents something far more fantastic than any visiting spaceship could be."

Beckwith shook his head in bewilderment. "Coming from the curator of Erie Planetarium that sounds—well, it just doesn't sound credible. Do you realize that you're inferring that at least one other of the solar planets is inhabited? And only a year ago you yourself sponsored the report specifying in detail why any sort of life comparable to human life could not exist on any of them? Mercury is too hot; Venus is a world of poisonous vapors; Mars had

insufficient water and too much carbon dioxide; the outer planets are unbelievably frozen and——"

"I know," Dr. Frick interrupted. "But wait. To-night we will examine the thing which we thought was a meteorite. I had to return for certain materials. And besides, Tom, I want you there. I feel that I need your judgment. You're sufficiently phlegmatic to offset my own fancies."

SOMETHING of the other's intensity of interest permeated Beckwith's harried mind. Whatever might be said of Dr. Allison Frick, he most certainly was not an idle dreamer. And yet, Beckwith was thinking, imagination does have a place in science. Contrasted with the two thousand million years of the solar system's present existence the history of civilized man is a mere second of time. The speculative intelligence of the human mind is only at the threshold of discovery. We can actually see so little, and yet that little is enough to show us great and mysterious vistas which are ahead.

"We may be wrong," Dr. Frick was saying. "But before another day is passed I believe we shall know for sure."

"What a report that would make!" Beckwith exclaimed suddenly.

Dr. Frick was studying his assistant soberly. "I was thinking of that, too. Tom, we probably won't make a public statement. So far as the world at large is concerned you and I will only be off somewhere taking a much needed rest after our sky jaunt. That should satisfy them. But in the meantime——"

He did not complete the sentence. His long face became set in determination as the two hastily arranged for a secret departure. As the minutes passed Beckwith became more and more aware of a disturbing something which was not unlike some nameless fear. One thing only was certain—Dr. Allison Frick was sincere.

It was nearly dusk when they reached the lonely ravine. Dr. Frick led the way, his long legs striding impatiently over the rough, bushy ground. Beckwith sighted the seared plot before they reached it. Getting out their flashlights the two men dropped down to the ground.

Beckwith gasped at sight of the spots of burnished metal which evidently had surrounded the huge mass of meteoric iron and nickel.

"It was nearly spherical," Dr. Frick was saying. "See there—the outer layers are very thin. But for the crash, they would have been burned entirely away long before striking the Earth."

"That is true." Beckwith placed a trembling hand upon the jagged edges, where the outer shell had been smashed by impact with either the Earth, or the helium-radiant of the strato-ship. "But you are sure—absolutely sure that this is the meteorite which crashed us?"

"I have proved that to my satisfaction, Tom. There are bits of the duraluminum of the radiant tank which have been jammed into the meteorite. I brought a few scrapings with me to the planetarium this afternoon. The microchemical reactions I obtained convince me that the odd bits had indeed come from our own radiant tank. Furthermore, Tom, the bulk of this thing is definitely the nickel-iron of a meteorite. You know, of course, how simple it is to distinguish between natural, terrestrial iron and that which comes to us from space. The crystalline structure is clearly meteoric."

Beckwith turned to look closely into the face of the curator. "Frick," he said softly, "you're dead in earnest about this. You've got some idea what it means."

"Thanks for your confidence in me, Tom." Dr. Frick gave a short, mirthless laugh. "Candidly, I couldn't go ahead with it if I didn't feel you were with me. It's like groping in the dark

into a strange, alien world. You know as well as I that this is unorthodox talk for an astronomer."

"Go ahead," Beckwith ordered. "You mentioned that this meteorite had been fabricated."

"Quite. Throw your flash close to the broken edge of the outer shell. What do you see?"

BECKWITH scrutinized the rough material closely. His voice rose with excitement. "It's in layers—there are six distinct coatings of something here."

"Really three layers," Dr. Frick corrected. "The dark material is insulation between the plating and the core, and between the three very thin plates themselves.

"Which are silver!" Beckwith exclaimed.

"Yes, but there's something still more important. Don't you see it? The plates are insulated electrically. This was not a perfect sphere. There must have been extremities at each pole where the spherical plates connected for reasons which we shall never know. In other words, Tom, this suggests a phase of electrostatics which far excels human knowledge of energy in equilibrium."

"But still I do not see the meaning behind all this." Beckwith sat up straight, a puzzled frown etched upon his forehead. His attention was held by the curator's tense interest in the several bits of apparatus he had brought along from the planetarium. Dr. Frick was laboring under difficulties, lying flat on the ground and squinting in the combined glare of their flashlights. Beckwith watched intently.

The outer plate had been drained of whatever energy it might have had, yet the second and third gave forth a rather feeble reaction in the electroscope. Hastily now, the two worked together connecting the two plates to the instruments which they had brought along in the car. Almost at once there arose a tenuous cry.

Beckwith felt his scalp prickle. Involuntarily he grasped Dr. Frick's arm. "It's the same sound we heard up there."

"Yes." Dr. Frick's voice was sharp. "But listen."

The tones rose and fell, now undulating as with a rhythm which had been designed by willful intelligence.

"It is nothing human," Beckwith stated. "I can make nothing of it."

"Except that it's a revolutionary demonstration in electrostatics," Dr. Frick's voice was firm and yet strong with enthusiasm. "Tom, there is a meaning behind this. It can't be accidental. You saw how little energy was evidenced in the electroscope,"

"I see what you infer. Perhaps out there in space—on one of those other planets—there's an intelligence seeking to penetrate the mystery of Earth. Great Scott, how many others of those meteorites which fall continually to Earth have been like this? This may not be the first."

"Likely not. But we have no way of knowing. The fall through our atmosphere is enough to burn off all such layers as is on this particular meteorite. It was only the one chance in a billion that this one struck our helium-radiant. But, Tom, we must get to the heart of this mystery. You remember how it was up there? In a way it seemed that we were momentarily free of Earth's clutch. The longing——"

Abruptly the weird cries of the meteorite died out in a wavering gasp.

"It's gone!" Dr. Frick gasped. "We've lost it now. The energy is dissipated."

"No, it isn't that." Beckwith put out a restraining hand. "Look, Frick, something is happening to the shell of the meteorite. It's glowing—that one spot there—like a phosphorescent ball."

As the two men stared the strange

ball of energy expanded as if gathering strength into itself. Again it faded and as suddenly the sound amplifier—which by chance had been included in the temporary laboratory—again began to hum with the eerie vibrations. But this time the perturbing voicelike qualities of the intonations were uttered in a series of jerking cries.

Beckwith's voice came in an awed whisper. "It's alive."

"Yes, yes!" Dr. Frick seemed annoyed. "But we are getting nowhere. This may be evidence of intelligence and yet we're completely in the dark."

"That series of notes could be a sort of communication, Frick. Good grief, man, it's like listening to a child's voice crying out that it's lost—like a voice in the dark. But they aren't words. They don't even sound as if they were a code. It makes you forget that it's nothing but electricity—nothing but imprisoned electricity being expelled bit by bit and transformed by our sound box from electro-static force into audible sound waves."

"Technically you are correct, Beckwith. But here's the point. What is it controlling the flow of electrical energy from the meteorite? Oh, there are hundreds of questions. Why wasn't all of the energy dissipated when the meteorite struck the ground? Or might not the energy itself have been generated within our own atmosphere and stored within the outer shell during the fall? Then again, why should the energy seem to accumulate in that one spot of the sphere as if by willful intelligence? Tom, this is unbearable. I must find out."

"Wait!" Beckwith leaped to his feet. "I have it. We can transfer the energy to a series of cells and then take it with us to the laboratory. We can't move several tons of meteoric iron, but we don't need to worry about that. The thing—whatever it is that is controlling that stored-up electricity—is trying to tell us that. Can't you understand it, Frick?"

"Good, Tom! However—well, don't you understand that we can't attempt this at the planetarium? You know what would happen. The moment it was generally known that we were working on an experiment to prove the existence of intelligent life upon another planet, we should be laughed out of countenance. I think we should try to transport the controlled energy to the workshop I've rigged up at my own house. What do you think about it?"

"That would be best; I quite agree with you. The world will think us mad. Well, maybe we are mad, Frick. But notice that—that ball of energy! It's like an eye in the dark, an eye that's looking at us and waiting and wondering."

Dr. Allison Frick threw an arm about his youthful assistant. "Tom," he said, "I was under the impression that this was some private fantasy of my own. But with you believing in it, too—— There are several bell-jars in the back of the car. I chucked them in on the off chance that we'd want to protect some bit of something or other from the atmosphere. There are three sizes. Superimposed, and with metallic shells in between, we can connect them in much the same manner we attached the sound box."

"There's enough stuff here!" Beckwith exclaimed with boyish enthusiasm. "If only we can get the—the thing in the meteorite to understand."

DR. ALLISON FRICK had succeeded in closing his office at Erie after two and a half days of rather intensive work. There was much yet to be done with regard to the amazingly clear photographs which had been obtained in the gondola's skyward trip. Too, he sorely missed young Tom Beckwith's very capable assistance. Nevertheless, he had arrived at a point where a rest

of a few days at least would not seem unreasonable to his associates. Their acclaim for his daring adventure was still at full glow. It was natural, many of them said, that he should refrain from confining himself too closely to the planetarium after such a nerve-straining experience.

Hurrying to the large attic room which he called his workshop, Dr. Frick approached the tense figure who was bending over a bewildering bank of static electricity controls. At sound of his footsteps, Tom Beckwith straightened up.

"Still no results?" Dr. Frick questioned eagerly.

"There's something here," Beckwith said in a slow, thoughtful tone. "But I don't know yet how I got it."

"What do you mean?"

"Look!"

Very carefully Beckwith removed the lid from a glass jar and withdrew a small black cricket.

"It's dead," Dr. Frick remarked. There was a deepening frown of perplexity across his face.

"I know. The shock killed it. You see, I've been easing in little amounts of positive electricity to try to make up for what we lost in the transfer. At one time I thought the power which controlled the energy in the meteorite was attempting to reëstablish those sounds again, but nothing remarkable happened other than a few besitant sputters. Then, quite by chance, a cricket came from somewhere. I saw it running toward the equipment there and tried to catch it. The thing jumped, landing squarely across the two wires leading to the sound box."

"What happened, Tom?"

"Just this. Watch."

Dexterously grasping the lifeless insect between thumb and forefinger, Beckwith lowered it so that the chitinous shell contacted two points. Instantly the insect seemed to pulsate as if with life. There came a faint chirping sound. The body was vibrant.

"I've added more energy," Beckwith was saying. "But so far this is the only reaction I've been able to attain. I can't short-circuit it with my own hand—or even a strip of metal. The energy is there in the storage cells. You can see that for yourself through the actions of the cricket, yet nothing else will give any result. It's the life-force controlling the energy that accounts for it. There's no other way of explaining it. But why?"

His gaze riveted upon the grotesque semblance of life in the tiny insect, Dr. Frick quickly removed his coat. "Tom," he whispered, "we've got it. We've really got it. But what is it, and from whence does it come?"

THE CHIRPING cricket-sounds had begun to change. A prolonged pitch, not unlike a human sigh, seemed to emanate from the pulsating body. Both men turned to look at the other.

Dr. Frick said: "The voice, Tom. The voice of the meteorite."

"It's the same. That's no cricket sound. Besides, you saw for yourself that the insect was dead. If only we knew more than we do of electrostatics. Frick, seeing something like this brings it home to you that we've virtually deserted the study since the nineteenth century. Since then our knowledge has expanded almost exclusively in electrodynamics. That's what makes this so baffling. We don't understand even the mechanistic fundamentals."

"Not that alone, Tom. Even electrostatics won't give us the answer to the motivating force behind this."

"What do you mean?"

"Just what I've been trying not to think about ever since we first heard that terrible, appealing voice from the unknown. Pure logic says that we might eventually explain that cry by understanding the mechanics of gravi-

tation. But something else suggested that there was reason and intelligence in it—just as there was reason and intelligence in the controlled flow of electrical energy in the smashed remains of the meteorite. Tom, will you look—I swear that cricket is alive!"

The two stared in awe as the insect seemed to struggle to right itself. Suddenly cries of amazement escaped them. The cricket was no longer suspended between the points of the apparatus. It was moving, though slowly and awkwardly, across the table toward them.

"Frick! What are you doing?"

Beckwith stared after the curator's hasty movements wonderingly. Dr. Allison Frick moved with frantic speed. Hurriedly now, he began to assemble odd bits of laboratory equipment about the table.

"Keep watch over the cricket," he said once.

Beckwith nodded but continued to watch Dr. Frick's unaccountable activity. Soon a light of understanding began to show in his eyes. Dr. Frick had dragged the electrostatic machine across the room and was connecting its terminals with certain of the materials which he had laid out on the table. At last he mumbled: "Ready."

"The insect is far from normal," Beckwith remarked. "It acts as if it only half understood how to control its body."

"Exactly." Dr. Frick's tone of voice was more low pitched and steady now. "But I think I see just a little light, Tom. When you stop to give it thought—in view of the staggering vastness of the cosmos—it is almost unreasonable to presume that the isolated little planet, Earth, alone can spawn speculative life. We can dream of spaceships, but we can't build them. Physiologically and mechanically, interplanetary travel is unobtainable. But there is more to a living, intelligent being than flesh and brain—an elusive something which actually lifts us above all other animal life-forms despite inferior bodies. Sometimes we try to grope for an explanation by giving it a name such as 'soul' or 'spirit' or 'consciousness.'"

"But that," Beckwith exclaimed, "that is just a cricket."

"No, no. It is not a cricket. It is something in a cricket's body—something which crossed over to us on what was thought to be a chance meteorite. By sheerest luck, Tom, you and I have stumbled into a new corridor of knowledge. For the time, it makes all the rest of what we've learned seem topsy-turvy. That's true of every other great accidental discovery. But quick now—build up as great a potential in the machine as you can. I'm gambling on chance—it's been with us this far—and I know that the will within the body of that insect knows more about electrostatics than is known by the whole race of humankind."

Beckwith was not surprised that his hands were trembling as he grasped the crank of the machine. The world would pronounce them both insane. And yet, there was a fearful beam of truth in Dr. Frick's tense probing into the unknown. Beckwith was building up a significant charge over Dr. Frick's insulated body. Now, the curator was leaning forward over the table, extending a forefinger tentatively toward the apparently alert and understanding insect. Abruptly, the cricket stepped forward.

THE CONTACT could have lasted but the fraction of a second, and yet in that terrible interval it seemed that time had been warped beyond material conception. A crackling, daggerlike charge of energy shot from human hand to the black chitin of the cricket. Instantly a cowl of opalescent haze surrounded the bodies so that they no longer seemed a substantial part of material existence. Beckwith was conscious of crying out—yet his mouth gaped in the sound

which for the moment had neither beginning nor end.

It seemed that they were again in the gondola far out in space and hearing for the first time the vibrant animal cry of the charging meteorite. Only this time Frick's eyes were gleaming with unnatural brilliance as if he were seeing a sight too fantastic for human assimilation.

As abruptly as it had begun, the fearful discharge ended. Beckwith, his body quivering, drooped weakly upon the electrostatic machine.

"Tom!" Dr. Frick was calling out. "Did you see it, Tom?"

Beckwith moved his head feebly from side to side. "The cricket's dead," he muttered. "Burned to a crisp."

"No—no, it's not dead. Not really dead." Dr. Frick was speaking with intense excitement. "The experiment has been a success. It isn't human life but it has reason, memory, intelligence, culture—all incased within the efficient body of the insect. I see it now. The life force from that meteorite revealed it, Tom. It came from another planet where animals of our type are unknown. It was not an insect but an intelligent being. It was seeking life here, and could not contact our bodies because of the radical structural differences. That explains why the manifestations of light and sounds had no intelligible meaning for us, although we could sense a reason behind them. Do you understand?"

The two stared eye to eye, both visibly shaken by the enormity of what had been revealed.

Beckwith's voice quavered with emotion. "But there was nothing on the meteorite except static electricity——"

"Which is the secret of interplanetary travel," Dr. Frick spoke sharply. "The creatures of the other planet have discovered the laws of consciousness projection. The secret will be man's, too, when he masters electrostatics. Where did this life come from? I could not tell for sure. In the brief second of contact we could not achieve full communication. From Mars I think. Such a cricketlike being could exist there. But that's not the biggest thing. The lesson for us is that mnid, consciousness, ego, must be reduced to their electrical denominator. This was a terrestrial cricket and yet, for just a moment, its body was controlled by the electrostatic formula of that other-world being."

Beckwith interrupted: "Yes, I know. The secret is ours, but—it must remain ours."

"Right." Dr. Frick nodded. "Until we learn more of electricity at rest. And then," his face brightened, "we shall no longer be chained in isolation. A new day is dawning, Tom—you and I have just seen the first streaks of sunlight, because we dared rise higher in the sky than any other man."

Dead Knowledge

by

Don A. Stuart

Dead minds and unknown hieroglyphs alone held that Death-knowledge

THE sun was a red ball sinking at the end of the broad, paved avenue that ran straight to the east. Its long rays slanted down across the city, across the towers, gilding their clean-lined hulks with a parting gold. An absolute silence wrapped the whole majestic city, a silence that had settled on, and into the three men standing immobile on the short, green grass of the Circle that was the city's center. In a dozen directions great arteries radiated through vast chasms between artificial cliffs that lifted a hundred stories, a thousand feet into the dark blue of the sky.

A restless breeze, stirred by the approaching chill of twilight, soughed softly down the street, around the immense bulks of towering buildings leaping upward, sweep on sweep of fine-drawn graceful line. Bar Young stirred restlessly, obliquely eyed his companions with an uneasy tensity. "That—that's why nobody noticed us."

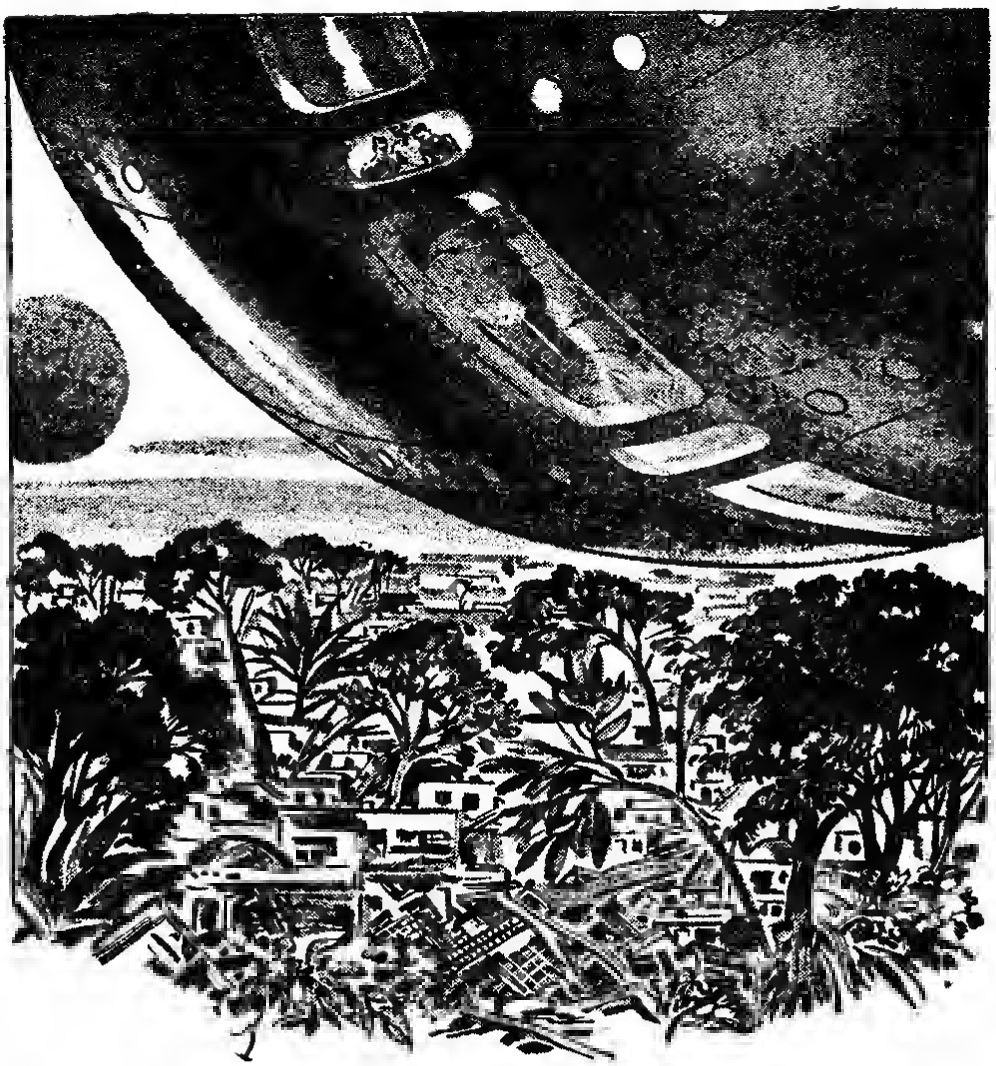
"There were lights in this city last night," Hall said in a voice lowered unconsciously by the pressing weight of silence. "It can't—can't be deserted."

"I thought for a while that the people might be a race of day-sleepers—an owl people—but even at 4 a. m. no Earth-city could be this quiet, so motionless. And however alien these people of a strange solar system may be, they must be in many ways similar to man. Those buildings—this park—all their works might be those of some city of Earth. It's a ghost-city, a deserted place like the abandoned mining camps." Ross looked about with a vast unease.

"We could try one of the other cities——" suggested Young. "We have to find them—the people—somehow. Twenty-seven light years—three years of traveling—to reach this system, to find five dead worlds, and only this one habitable. And inhabited; such cities as this cannot be simply—abandoned. There was no place for the people to go, no other planet they might have migrated to. And no signs of space-travel or space-ports that might accommodate spaceships, even such small ones as ours." Over his shoulder he glanced back toward the 300-foot bubble of steel and quartz that had brought them across vast gulfs of emptiness.

The swift-sinking sun shrank below the eastern horizon, its beams lifting from the level of the park, climbing slowly up the sides of the towers, painting green and blue and pale-yellow stone to red. Polished metal reflected its brilliance in flashing gleams from the curving, rising buildings that towered about them, a ring of 1000-foot giants dwarfing the low trees of the park, and the 100-foot sapphire needle of crystalline light at the center of the circle. Slowly, the lifting light left the feet of the buildings, the deep blue of the sky overhead darkened with a fast-running twilight.

Still darkness crept into replace the



"The same language," said Hall. "We can find no clues, then—never read the secret——"

silent daylight, welling up from the pavements into the shadows. The thin, clear air of the planet, utterly quiet and dustless, held no light within it; the shadows became black and sharp. The deserted city of daylight began to people itself with unseen things that moved soundless in the silence, pressing the lengthening shadows toward the three men with a soundless, eager menace.

Ross shook his head slowly. "We've got to find out what happened here—why this city was deserted. There is something—wrong. A ghost town is something understandable—a town, built by a lode of mineral, that ceases to be when the mineral is gone. But a city—a magnificent city of 1000-foot towers and ten million homes stretched over fifty miles of meadowland cannot be deserted. It's impossible. Even—and I thought of this for a moment—even a plague could not drive out every man, every woman and child. There would

be watchmen, caretakers, there would be sanitation corps men to work and rehabilitate the city. It is too much, too much of labor and thought and effort to be neglected utterly, however fearful the plague might be.

"There is something wrong." He watched the uneasy shadows creep across the pavements toward them, engulfing them as the light of the city faded, the last faint sun-rays touched the tips of the highest towers for a lingering instant —and vanished. The night-wind grew, murmurous and mumbling behind the buildings, freighted with the communications of the unknown rising on the flowing tide of dark.

HE turned abruptly; a soft, blue light was growing on the building walls—something behind them—— At his start the others turned, nervous hands grappling suddenly to heat-guns. The sapphire needle behind them was a crystal of living fire that wavered, grew in a rising rush, and retreated for a moment to gather strength for another upward rush in the dusk. Waves of shadows forced back by it seemed to gather denser in the buildings' outskirts, spreading invaders hurled back by the light.

With a rush the light mounted suddenly to a needle beam that stabbed into the dark sky, to winking, unfamiliar stars, in strange constellations. Simultaneously with the jetting light beam, a low, sweet hum built up, up to a ringing music that floated out across the silent, darkening bulks about the park. It rose and fell and rose again in sweet cadences, to fade away in plaintive notes. As it faded, light, a million lights on a thousand streets grew, a vast lighting system coming to life to drive back again the shadows crouching angrily at the feet of the towers.

Swift darkness fell with the sun's disappearance, a darkness that made the unlighted buildings vanish in black needles against the black, star-flecked sky. Only their lowermost levels were clear in the soft rays of the street lights, fading into rising dimness of black, lightless eyes—polished glass that gleamed dimly without being illuminated, unexpected winkings of light from ranges far above the effective limits of the lamps.

Bar Young's breath sucked softly. "Automatic—automatic lights controlled by the coming of night. No light—no window shows a trace of illumination within. Only the city's mechanical watchman functioning to turn on the lights of a deserted waste. That was the light we saw last night from space, as we came in. Those were the lights we saw in the western cities already in night when we were landing.

"They are gone—gone, it must be, forever, and gone not hurriedly, but calmly, putting away all cars, all traces of their occupancy in neat order. But why, *why* have they left this place?"

Hall moved forward into the light of the crystal and out of the lean shadow of their cruiser. "I don't like this city —particularly at night. There is something wrong with it, the same thing that made the people leave. It was the city, I feel somehow, not the people that made this desertion necessary."

Ross moved his head in a vague gesture, half agreement, half negation. "The city—well—I have the feeling you do, the oppression of the silence and the dusk. Those buildings stand there, crouching in the darkness, half-seen things that have a suggestion, in this city of deserted mystery, of some menacing thing. But isn't it more our own vague feelings—strangers from an alien world and solar system, who have stumbled on this cosmic mystery as the quick dusk of this planet set in—that are to blame?"

Young looked at him under frowning brows, a wry grimace twisting his

mouth. "The original builders deserted it. Something, human or inhuman, forced them to a course unbelievably extreme. Yet—there is no sign of wreckage, of invasion, of trouble. The city is clean, so clean that even the normal litter of a great city does not appear. We have to investigate, but—I don't like this city of night. We can go to one of the daylight cities."

"This is one deserted city," said Ross abruptly stubborn. "I feel I'm fooling myself with man's instinctive, age-old fear of darkness, and unknown things. The others probably aren't deserted, and this is our opportunity to study the race unhampered. Their language, perhaps, from books and pictures. I say we should investigate, visit some of the homes we saw on the outskirts. Our ship is slim enough to move down that main artery without striking anything, and in a few moments we can get some indication of what the people who deserted this place were. Therein may lie the whole answer, a vagrant, migratory people descended, perhaps, from birds, who move en masse from city to city as the seasons——"

YOUNG looked at him keenly, and his voice trailed off apologetically. "You know as well as I that no civilization of 1000-foot towers would rise from a race of migratory habits. No, the people who labored for this city intended to remain, generation after generation, and they built with lofty permanence in mind. Hall, what about that language? I think—but you're the expert."

"You saw what I did—you're probably right. As a guess—the signs, that posted notice on the tree, looked to me like an ideographic writing."

"Ideograph——" Ross repeated vaguely.

"Picture writing, like Chinese or ancient Egyptian. It is a sort of completely conventionalized rebus writing. In a civilization such as this, it must be highly idiomatic, impossible to decipher without a hundred years of study."

Ross shook his head stubbornly. "Then we'll have to investigate. We can go down that main avenue, out toward the suburban districts, and stop at some apartment house." He pointed down the great avenue that stretched out straight toward the east. A faint lingering of lighter sky gave substance to the vast, hunched shadows that waited down the long passage. The night pressed down on the thin line of lights, crushing their illumination to the ground, obscuring the unseen things that went on in the higher, darker silence. The silence of the city brooded again, unbroken. The dusk-wind died away as night gained full sway. A moonless sky—sprinkled with the myriad bright, blind eyes of the stars looked down sightlessly.

The silence held them in its grasp, froze them for long seconds before Ross moved, half-angrily. "Let's go down there." He spoke in a voice that echoed in startled protest against the blind, high walls. "This silence gets you." His voice was suddenly softened. He turned and walked to the open lock of the ship, his rubber-soled feet seeming noisy in the ringing corridor.

A silent ghost, the ship lifted on her antigravity field and drifted down the broad avenue, the space-fields meshing in the soundless structure of space to pull it forward, as noiseless as the city itself. Only the soft purr of the atomics, the familiar whine of the circulators, changed the soundless menace of the city to a world of reality, of living things moving in the light.

The hot, white beams of the forward landing light swept brilliance down the avenue ahead as the silent, waiting towers moved by in stately procession—broad, brown-paved streets, gray concrete sidewalks, a thousand shops, their broad windows sparkling in the light of

the ship. Goods of strange pattern and unguessed purposes lay still behind the windows of the locked, dark stores. "They did not take their possessions," Young said softly.

Ross' fingers flickered over the controls, his iron-gray eyes level and intent on the avenue before him, his powerful, stocky body hunched over the controls in self-determined blindness to the dark mystery beyond the windows. Hall's lean face looked strained and tense; to him the presence of the goods seemed no surprise, nor would its absence have changed his opinion one iota. His dark, keen eyes followed the moving windows silently, watching them slip behind.

The towers shortened, pulled down from the skies to become squatter, smaller buildings as they left the city's heart. Swift miles fled behind the cruiser's sleek, bright-metal form. Ten times the speed of light lay within the powers of her fields; she idled now, and the wind of her passage chuckled meaningful laughter in her wake. The shops gave way to blank-walled business houses, then again as five-story apartment houses, set back from the avenue, spaced by green, tree-dotted lawns, appeared.

The cruiser slowed, halted in the street. The burbling of the wind died away and the silence of the city wrapped it again. No cheep of insect or ruffled piping of birds disturbed the utter quiet as the purr of the atomics died away. Ross rose, his feet scraping noisily. "Bring your camera, Hall, and let's see what we can get. There must be some indication in there—some reason for this desertion." His voice echoed pleasantly in the ship, breaking the pressing silence in rolling sounds that continued, gave life to his voice. The vastness of the city's ways drank in the sound, made voices flat and as unnatural as the city.

THERE was no door, but a grilled gateway that led into a courtyard open to the still night sky. A dozen doors opened from that; a fountain pool lay with unruffled waters, reflecting the starlight save where the smooth surface was broken by the spider-web fronds of some water plant showing minute red flowers in the light of their atom flares. The three floors of the building were terraced back from the courtyard, so that each story had a small, railed terrace running entirely round the court. Onto these the doors of the apartments opened. Pale-blue wash of some sort laid over a plasterlike material reflected the light of their flares, limning each detail of the patio clearly—the winding stairs that led up from terrace to terrace, the bright blue and white tiles of the fountain pool——

"They knew how to live," said Young softly. "Three years in that metal bubble and this place, even in the silence, looks attractive. Why—why—*why* should any being, who loved life and beauty as the creators of this must have, leave this building, neat and ordered, a perfect home?"

"Try that first door, Hall," said Ross steadily. "I'll try the one on this side. Young, you want to take the second one?" Ross reached his goal first, studied the knob of the portal of golden metal for a moment, pulled at it gently. The door opened toward him, and his call brought the others.

Curiously familiar the furnishings seemed, chairs of gracefully curved, glowing metal—an aluminum bronze with a matte, golden glow—upholstered in bright blue and white, a studio couch in similar materials, a desk in a dully glowing, dark-red wood. The silence of the city seemed to leak into the place with the opening of the door, making these ultimately human things more deserted, more poignantly alone, than had been the vast masses of the City, towering into the black hush of the night skies.

The room was lived in, the desk untidied by a torn bit of paper, scattered sheets of faintly yellowish parchmentlike material, a few scattered instruments evidently—humanly—pens. Hall moved toward the desk soundlessly, on rubber-soled feet over a carpet of bright, dark blue. A dozen lines of characters ran smoothly across the exposed sheet, from right to left, many-dotted, rounded characters, curiously like Arabic script; unfamiliarly dissimilar to Hall who read half Earth's polyglot tongues with ease.

Ross turned his head slowly, seeing the lattice-fronted cabinet faced with meters and three small knobs, the well-stocked bookcase, scattered pictures on walls, small tables. Discarded a moment before, it seemed, a newspaper in the strangely curved, many-dotted characters slashed a message across all its front page. The entire page seemed devoted to that one item—the secret?

Hall looked up at Ross' low word and followed his pointing finger. Slowly he shrugged and shook his head. "It's ideographic. I'm sure. The secret lies there, all right, open to be read. In full detail, no doubt, the story of the silence—the dark city under dark skies.

"We'll never know. These people, when they left, did not prepare for visitors. Why should they? They alone on the only habitable planet of their system, alone in a gulf of space we never would have guessed could be crossed by living intelligence, but for Hargreave's Accident and its consequence, the speed-drive.

"They left no primers for those to come, in their ordered—ordered? Why this paper dropped so carelessly, as though suddenly?"

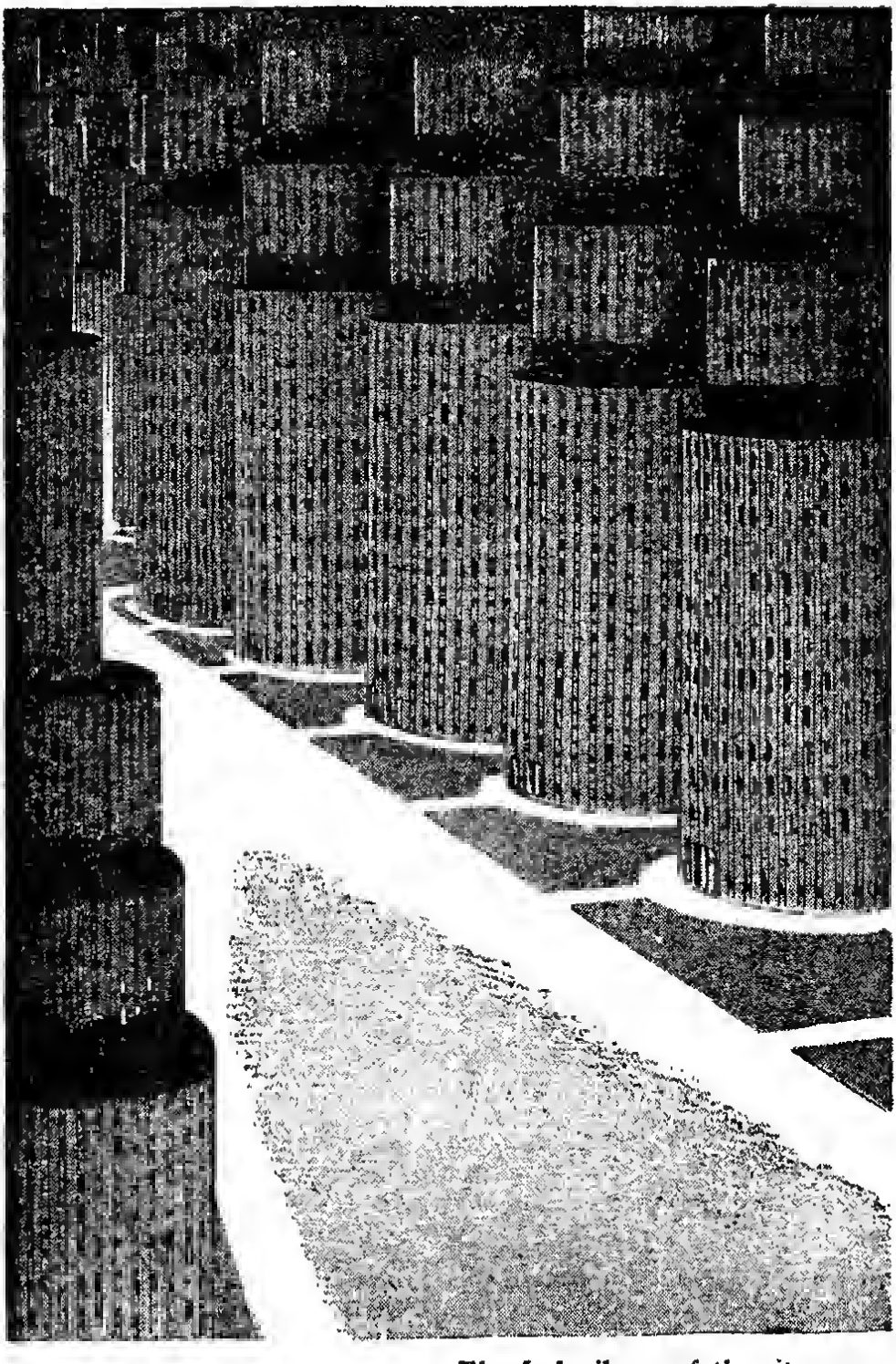
"There is a door there," pointed out Young, quietly.

ROSS STRODE forward, his square, blocky body determined in its movements. Slowly he opened the door, letting the strong white light of his atomic flare reach in. Abruptly he stiffened, his breath sucked in sharply, then slowly he relaxed. His head lifted slightly, and he seemed to look without seeing at the ceiling of the room beyond, his body curiously half-tense, half-loosened. "They were very human," he said softly. "But for that bright blue hair, she would seem a girl of Earth.

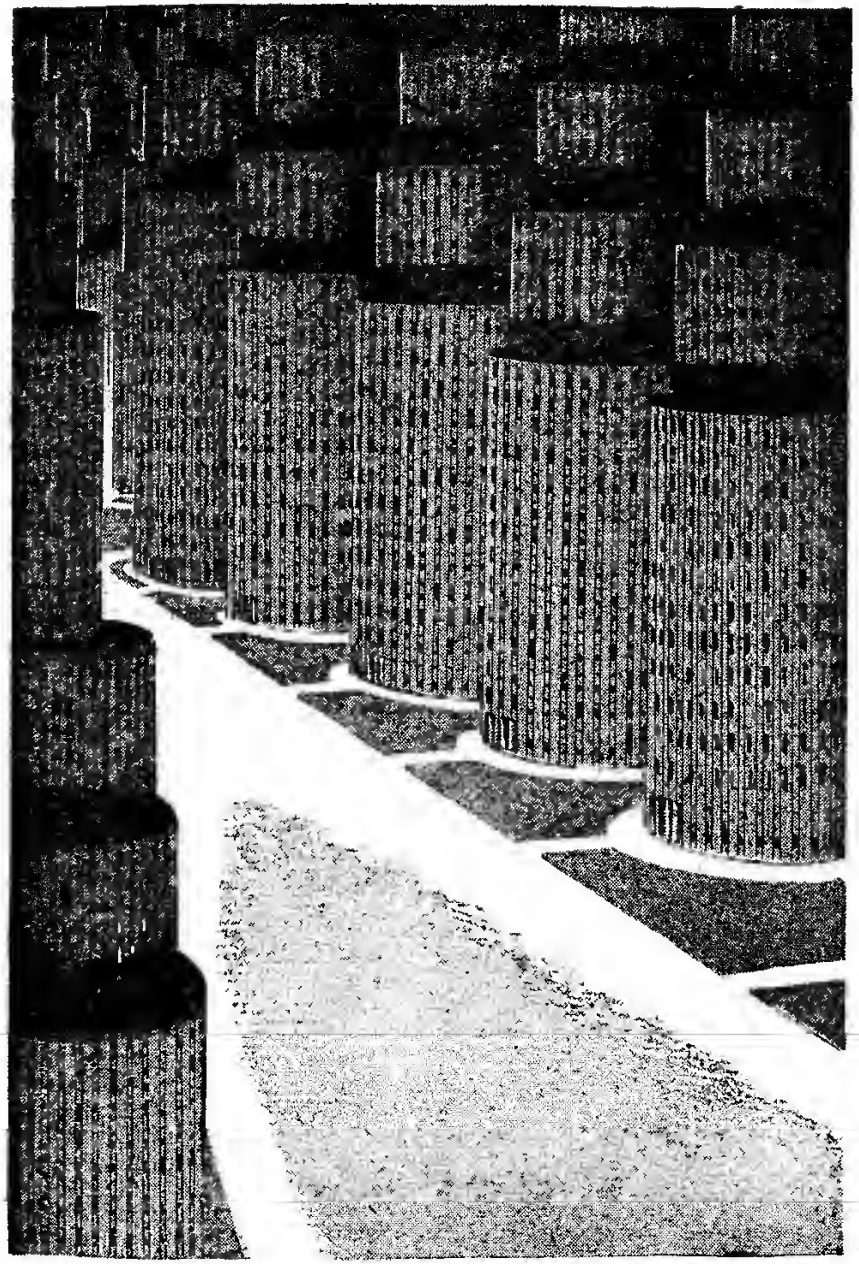
"Hall—Young, they did not leave. Here, here everywhere in their homes throughout the city they wait in silence. They are here, forever—everywhere, all about us, the ten millions of them who loved life and beauty."

Silently, slowly, as though reluctant minds dragged on by bodies captured by an alien will, the two moved toward him. Over his shoulder they saw the little room, the low, broad bed, two figures seeming asleep only now that dusk had fallen, wrapping the city in its silent cloak. A girl—twenty, she might have been if of Earth—slim and young, her smooth, warm face still now, with a look of tired unhappiness half smoothed away. From beneath the white, closed lids, tears had trickled and dried long, long since. The arms of the man who held her close were stiffened forever, yet so quiet, so easy had been their passing that no sign of death save their soft, gray blankets indicated more than a night-time's sleep. Soft, gray fabric of dust lay deep over them, as it lay over all the furniture in this place.

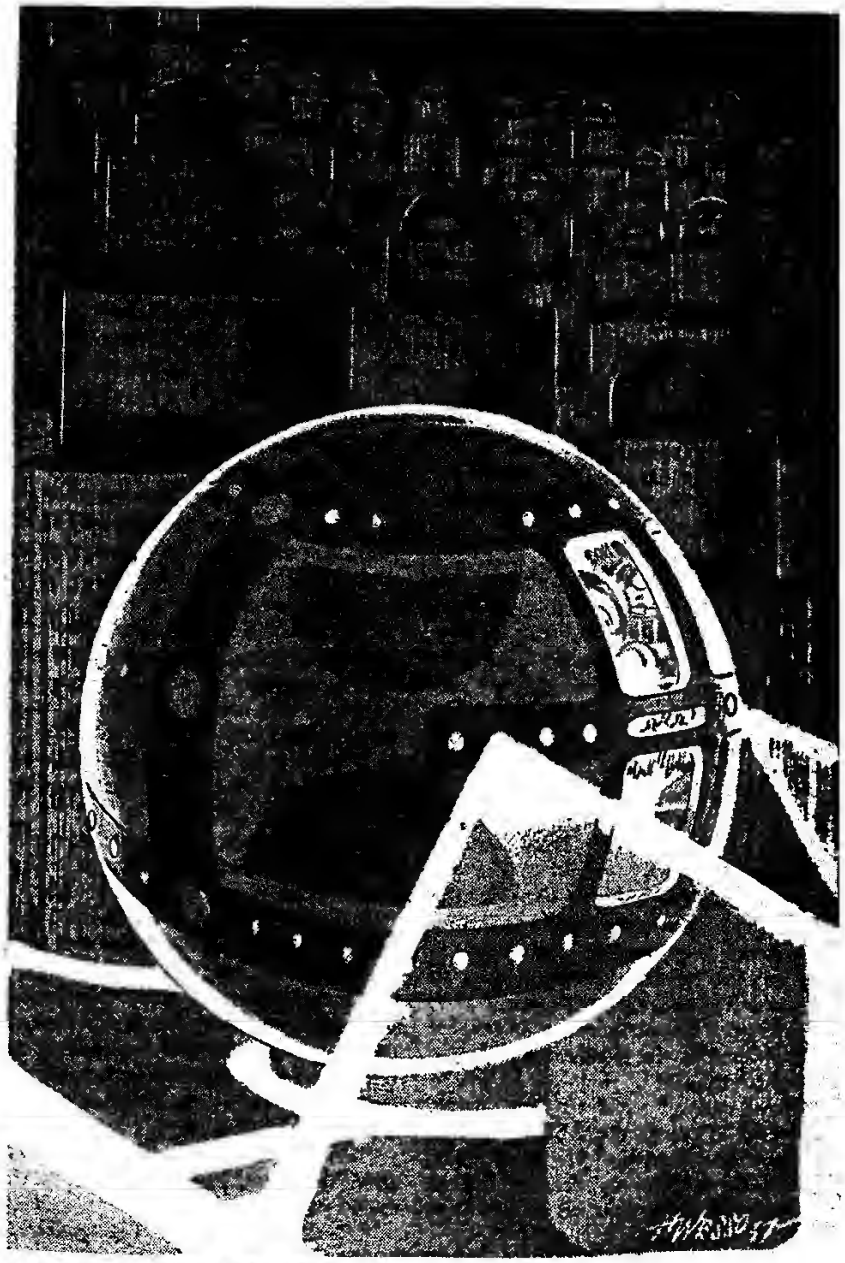
Something gleamed with a brilliant ruby light on the bed beside the girl, dropped from her relaxed hand. Softly, on tiptoe as though to save disturbing this sleeping pair, Ross plucked it from its place, and brushed the dust from its surface—deep-cut sparkling red glass, formed in a graceful bottle, labeled in bright green characters on whitish background on an inlet smooth surface of the bottle. Enigmatic, rounded characters, made plain by the blurred thing below—a rounded, evident skull, framed by a pair of fleshless hands.



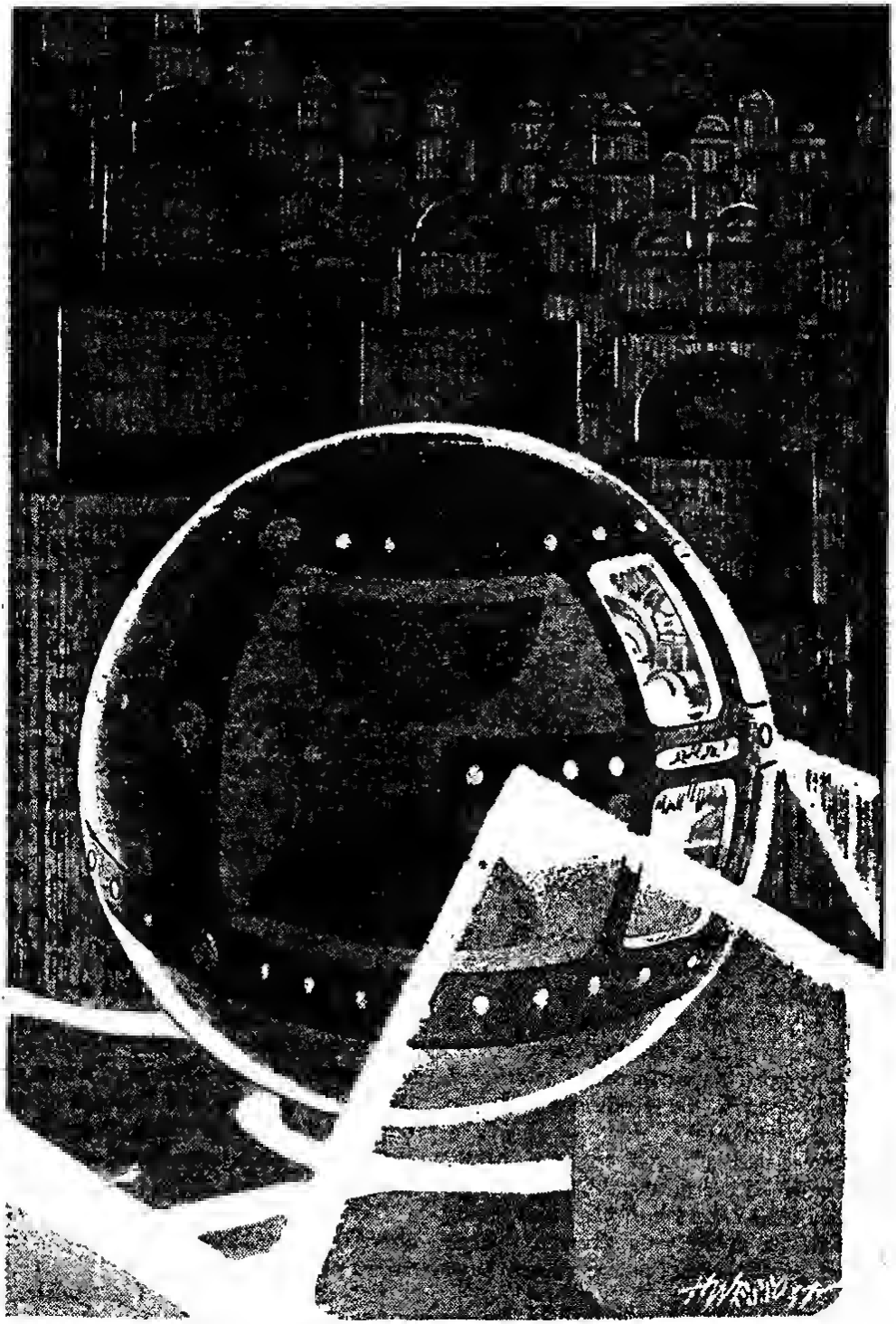
The dark silence of the city pressed



The dark silence of the city pressed



in behind as their lights fled on——



in behind as their lights fled on——

Softly the three left the room, went out to the courtyard of pale, pleasant blue under the sparkling night sky. Far off, the mighty tower of a building rose a dark finger against the pattern of the stars. Silently, Young lifted a pointing finger toward a strange constellation, a leering devil's head, with crooked, twisted mouth, and one winked eye. A bright star, and a lesser one for eyes; blind eyes, of which Sol, the ruler of a certain planetary system 27 light-years distant, was the lesser.

"Three years," said Ross dully. "Let's try these other doors."

Hall moved slowly toward another golden panel and opened it. The glare of the atomic flames lanced in. As the others came up behind his motionless figure, their eyes, too, saw into this room —this once lived-in room.

A CHILD—a boy ten years old?—slept in a chair, sprawled carelessly. Slowly Ross led the way in. Not till they rounded him did they see the dark hole in his temple. The door of the room beyond stood open. And as their lights moved, beams reached into the space beyond. Another child, a girl perhaps two, lay in the lap of a hunched woman's figure. Each was marked with the dark hole of a bullet wound; Hall saw the other marks first, small pricks in blanched, whitened areas—one in the child's thigh, one in the mother's throat. Only when they entered the room did they see the twisted, contorted body of the man, his lips drawn back in a toothy, hideous grin, his arm swollen, enpurpled still, clasped in the death-loosened grip of the other hand.

"Preservative," said Young softly. "Effective, a poison that killed in agony. He shot the others and protected them; himself he could only protect. That other couple—that poison must have had the same effect.

"Need we see more apartments—more of the tens of millions who built and labored and loved this city—and left, to go beyond the stars in the only way they knew?"

"No," said Ross softly. Then his voice became sharply agonized, "But why—*why?* No sign of danger, no sign of damage. What struck at them, forced them to this? A foreign state of this world? But what could war, or attack of any sort, offer that made this preferable? And this is the greatest city, by far, on this planet. It would have a greater backing of man power and machines than any other, if there are those silly artificial boundaries no visitor from space could see.

"No unproven threat could do this; no *threat* of death can make ten million people seek death.

"I know—we do not *know* that they have all killed themselves, but——" He stopped, and the silence of the city poured in, drinking the little sounds they made and washing them away.

"There could be no invasion from the other worlds of this system. We know them—and they're dead rocks. Two blistered in unbearable heat, one an airless boulder too small for atmosphere, and two frozen utterly. No alien race could menace them from their own system.

"Is there some other ranging race in space, some stock of slavers perhaps, working on a cosmic scale? No race that fought its way from mud to magnificence as these people did would kill themselves without fight. And fight of the magnitude that must result—they have atomic power, I'm pretty sure, for the city power is still functioning and gray dust gathering half-inch coats over the people—that fight would leave scars we couldn't miss.

"Why? What deadly thing could drive them to this, a century or ten centuries ago?"

"That long?" asked Hall softly.

Ross gestured, and again the silence welled in. "No sounds, no action. This

is a cloudless, almost rainless world, the temperature so constant, the air so clear, only a few light showers can have fallen. There are no seasons, and no winds or living animals to damage buildings. The grass grows on, the trees we saw seem long-lived. I don't know.

"But we must—we must——" He looked about him jerkily, his face whitened by three years of sunless spaces, whiter still in the flame of the atom-flares. "The menace cannot be from this system. It must have come from outer space, a power that wanders from star to star—a power that could wander to Earth.

"That may *have* wandered to Earth ——" He stopped aghast, looking at the other two. "Three years—and it will be six years before we get a word of news from Earth."

Earth—a planet of silent cities, its wandering ships stilled once, forever, the soughing wind alone whispering through crumbling cities——

"No." Young spoke sharply. His voice bombarded back from the shocked, protesting silence. "Let's go out—go to the ship," he muttered, turning sharply. The room fell dark behind them, a quiet, dark hush that was accustomed here stealing back as the flares passed out.

"We can try other cities. Somehow, crazily, I had not thought of nationalism. I had more the idea of a world state, such as Earth has now. But ours is only half a century old—long to us, but not to history. Other cities here may have different languages, as different nations on Earth did have. Those other languages might be such that we could translate them in time, and a lot shorter time. Primers not, perhaps, for people of other worlds, but for people new to this world, learning the story of its development from as little background as we have. Children come with no more language than we."

"No." Hall shook his head. "That isn't true altogether. For a phonetic language a child's primer might serve, but not for an ideograph. An ideograph is a rebus, a symbolized, conventionalized puzzle, from which all trace of origin has fallen away, tacked onto a highly modern idiom. That is not for unlearned children, but for those who know already the spoken language from which the thing takes start.

"We can try those other cities, there might be a living people—incredible—but if there is another language, a phonetic one, we have some hope of gaining essentials in a city where books for children might exist." The silent ship gained life and sound as the lock took them in. A circulator whined into soft sound near them and the silence of the city rested, knitting up its briefly tattered fabric as the shining metal bubble leapt away in startled, frantic flight. For an instant, the delicate fernlike fronds of the trees waved in the vacuum of its passage. Then the stillness and dark crept in and regained a long-held sway. Vague things stirred busily in the shadows that reached out again with the vanishment of the white, clear atom-flames.

THE SILENT world fled beneath the slanted rise of the ship, darkness giving way to a swift-returning twilight as the rise and movement brought the sun again above the horizon. Wordlessly, the three watched mist-shrouded hills rise from the plains, climb, and fall behind in diminishing foothills. A vast river-valley opened out, shadowed at one edge 100 miles beneath, sunlit at the far side.

The ship angled down again toward the soundless planet. The patchwork of farmed land mottled the green-brown of the ancient river-system's valley. Where two tributaries joined the stream a many-colored blot of steel and stone shadowed the land. The ship slanted down and the city below gained reality

and a third dimension as their altitude diminished from miles to feet.

Slow as a settling dust-grain, the interstellar cruiser drifted down on her antigravity fields, down toward a park-land in the city's heart. Dense, dark-green trees around a small lake, fed by a tiny meandering stream. Flowers had run riot, spreading in the unattended years back from the stream, around the borders of the lake.

No sun-tipped 1000-foot towers ringed this park; the buildings were broad and low, colonnaded structures of white and green and pale-blue stone. Glinting walls of glass brick poured the rays of the setting sun into the buildings to escape again through other glass walls as a mockery of internal illumination shining out into the evening sky.

Slowly the ship settled while Ross' gray eyes tightened. This park was not deserted. On smooth lawns, under clear waters of the pond, at ease in a hundred places, sleeping figures lay. Tiny, graceful cockle-shell boats lay upturned beneath the waters, beside their spilled occupants. On the lawns couples, trios, lay in an eternal sleep. The warm, strong rays of the sun, heat, the soft rains had bleached away the bright colors of the clothes they wore. Slow oxidation and time had embrittled them and the stirring breezes had torn the fabric to broken tatters.

Young moved toward the lock, out onto the soft turf, yielding under his feet. A group of four lay beneath a grotesquely gnarled, gracefully twisted tree. Two elderly people, man and wife, and a younger couple, the girl's bright blue silkens faded now to a color as soft as the wall of the building that rose two hundred feet away, beyond the brown-paved highway. Long rays of the setting sun reached down to illuminate her body, bent forward over the head of the man in her lap. Nestling beside it lay a ruby crystal, green labeled flask.

Hall walked past them and automatically Young and Ross fell into step behind him. "That building," said Hall slowly, "must have been an office building, or a public building. There must be written material there, and we can find in five minutes whether there is any need to stay in this city. These people took their poison—the same one apparently—in the parks, in many places. Look—parked cars. Their psychology was, in that degree, different. Their language may have been."

"If it is—the menace was not national, but planetary," Ross added.

Broad doors stood open, a layer of sifting dust laid down in the farther passages where the other breezes had not stirred it. On one white-stoned wall, between a series of small bronze doors, an inset panel of dark stuff behind glass covering, showed the curved, many-dotted characters of the strange, yet familiar language. Hall sighed. "The language is the same. We could try once more, say half around this world."

Silently, the three walked back, the smooth carpet of dust tearing beneath their feet. The quick dusk was setting in once more, the sun's last rays lighting the sky, but lifted already above the city's streets. Moments later the slender ship lifted once more into the light, and rose beyond the atmosphere's dim carpet to race around the world.

Shallow inland seas, their smooth waters darkened under night skies fell behind; the glowing patches of great cities operating long after their creators had given way to death and some unknown that hovered still about this dark world. Great cities, like mouldering patches of phosphorescent decay on the dark trunk of a fallen tree, and lesser towns that sparkled only faintly.

"This is a temperate zone," Ross said suddenly. "I'll head for the tropics. If there were two races on this planet, the difference in climate would be the most probable dividing factor, and this our

best opportunity to find a second language and a clue."

THE SUN rose again with the fleeting ship's motion, rose and held as they cruised a thousand miles round the bulge of the planet, to slant down once more as the dark green of temperate foliage gave way to the brilliant colors of a tropical jungle. The ship slowed over a broken patch in the spreading jungle growth, a city whose buildings lay in broken ruins beneath the thrust of climbing plant-life. Shattered stone and glass half-hid, half-revealed the crushed bodies of the people who had built and died here. Broken rubbery pavements twisted and writhed over thrusting roots of giant trees towering half a thousand feet above the low white buildings. There was sound here, the faint rustle of a billion leaves in the slow-stirring morning air, and sharp tinkle and crack of masonry disturbed by a life that thrust out blindly, voraciously for more, and yet more room.

Hall pointed silently to a broken, tumbled wall of glass bricks, fallen to jagged splinters in the sunlight, half obscuring the metal shelving it had protected. A crumbled, sodden mass of books bleached under the hot sun—the color and printed symbols lost under soft tropic rains and harsh, white sunlight. "The same language," said Hall briefly. "It was the universal language of this planet. We will find no comparative tongues to give clues and hints. There can be no Rosetta Stone in three languages. Everywhere here must lie a thousand, written, complete accounts—a million notes of explanation, a thousand printed accounts complete and exact, written by dead scientists.

"The answer of a million eye witnesses from the views of every type and class of man or woman. Why it was that parents murdered children, and then themselves."

"Why it was," added Ross thoughtfully, "they all, each one took such precautions their bodies should not decay. There is that which puzzles me. They went out of their way—the one we saw who shot those he'd tend to protect and injected some preservative, but poisoned himself—unpleasantly."

Hall shook his head uncertainly. "I don't know; a lot of races make a fetish of preserving the body, for rehabilitation in another time, a reincarnation in that flesh." Hall looked about him. A thousand bodies, some crushed, but none, never, a skeleton. "The red-flask poison must have been rare and hard to obtain, the injected stuff a common substance any one could get."

Ross shook his head with an air of ending the subject, "There is more to it than that. These people died, a world of them, by their own hands. Why, in a world without war, without threat of damage? And why in a world of scientific achievement should this fetish of body preservation have survived, and it alone, in the face of acts that denied every other custom, even the law of self-preservation?"

Hall shrugged wearily. "Let's go out to space. We are tired now, and in the atmosphere of this world our thoughts are mixed. Perhaps after rest, we'll understand it better—perhaps not. But we'll have to make a thousand photographs and ten thousand reports. There must be samples of soil and air, water and minerals.

"We aren't through. We'll have to study this morgue world for three months at least. Come on."

THE SHIP floated up as silent as the world it left, the antigravity field increasing, and the slow throw of the planet's spin sending it again into space. The drive-fields gripped, and the cool and dark of space received it. The spinning world shrank away in distance, the vastness of its puzzle contracting in their minds as the planetary ship with its

cargo of death, stilled happiness, and unguessed mystery shrank in size.

Young and Hall sat beside Ross, watching with unseeing concentration the skilled manipulations of his fingers, lulled by the soft purr of the atomics aft. Slowly Hall rose to his feet and turned down the corridor toward his room.

Young shook himself, the dark horror in his eyes fading suddenly, his tense mouth relaxing in a startled, half-sheepish grin. "Ye gods, that world gets you! I'll start the galley; *they* may be dead, but *we're* still living."

Ross nodded wearily, then nodded again abruptly as his eyes, too, cleared. "Gets you, is right!" he exploded. "Yes—go ahead. I suppose I do have an appetite, but——" He shook his head with the jerkiness of a boxer trying to clear away the fog of a blow. He looked up with dazed eyes, a new intentness and questioning in them.

"Back there, it's a dream. It's been three years since we saw a living soul, Bar, and something of the wear we've had on each other in this damned tin bubble eats down your resistance and appreciation of reality. Already that whole thing back there is beginning to seem a dream, another of those damnable nightmares you get from sleeping while the speed-drive is on. A world—cities, their millions dead by suicide, without a sign, an indication of the slightest trouble that might have affected them to make them do it. And—Lord, the silence! That silence is as unnatural as those almost-living corpses. Weren't there ever any birds to sing, no insects at all?

"That great dead city was too unreal to make the thing comprehensible; it seemed more like a posed question visualized with a ghastly accuracy."

"That was no vision, or if it was, we have to live and labor in it for three months or more. And think it over for three years going back." Young stared down from the port toward the slowly turning, mottled world, now 50,000 miles away. The faint blue haze of its atmosphere drew a blurring veil over its features, disclosing the gross outlines of land-locked seas and mountain ranges. The great river valleys showed as wide depressions, while the mantling, faint haze of blue light reflected from the atmosphere veiled the thin silver threads of rivers that had caused them.

YOUNG turned sharply and strode back to the galley. Presently he heard the strains of one of their stock of records grow in the ship as one of the others—probably Ross, he thought—started the amplifier. The lifting, quick-paced song caught him for a moment, and speeded his movements. The mystery floating there in space contracted into unreality; the strong, deep channels of familiarity and accustomed work diverted his conscious mind. Somewhere deep beneath the surface a vast weight of impending trouble stirred, and rose to bother him into uneasiness and haste as the record stopped and another started—a faint-toned plaintive song of the Martian colonists composed of the thin whine of Martian dust-winds and the sough of compressors. Surely, the composer had woven into it the same sphinx-mystery of the Martian sands, the scattered, cut blocks that never could have been assembled to form anything, but were shaped and cut on a world that never, in all its history, could have supported intelligent life——

His mind stirred uneasily. "Hey, pilot! Hall! Come and feed."

The song died jerkily as the needle-light died and the record-reel rewound automatically. Ross' heavy feet came down the corridor, and his stocky body swung round the corner. With half-unconscious eagerness, Young found himself watching him vaguely; he sighed gustily, familiarly, as he seated himself and Young turned away, vaguely satis-

fied. Three years of familiarity in the cramped "tin bubble"—that unimportant thing, the invariable sigh as he seated himself. Always, Young caught himself watching for it; always it came. His eyes swung to watch for Hall. He would pause in the doorway, lift his head just—so and sniff. As unconscious as Ross' sigh. Then he would enter.

"Hey, Hall—come on," Ross called. Leisurely Young slid the metal plates across the table, pans of food. In a momentary pause, the ship was suddenly silent, the air mechanism off, the atomics cut down to soundless idle.

"Hall——" Young stepped into the corridor doorway. The vague unease welled up in him as the silence of the ship stirred strong memories that had seemed to fade into the limbo of nightmares and things of unreality. "Hall ——" He walked with spaced, hesitant steps toward the closed door of Hall's cabin, threw it open and grunted in disgust. "He's asleep," he threw over his shoulder to Ross, peering round the corridor. "I don't see—how he could have——

"Ross," Young's voice was very low and still in the corridor, "he's got——"

Ross' hulk edged by him somehow, darting into the little room. For an instant his great, thick-fingered hand clutched the green-labeled ruby bit of glass, then dropped it to crashing fragments on the metal floor-plates. Roughly he turned Hall's quiet figure to the light. It moved with a curious solidity, as though in one stiff, solid piece—legs, arms and head in the same rigid position. Ross jerked back, rubbing his fingers stiffly on the tough fabric of his trousers, darkened eyes tense on the face before him.

THEY of the planet had died, always, with closed eyes. Yet Hall lay with eyes wide-opened. Jerkily, Young snatched a carelessly dropped shirt, and threw it over the white, staring face, over the black misery of horror in the eyes.

"It got him," Ross gurgled unpleasantly. "Hall—it got Hall. Hall's a man——"

"Notes"—Young clawed frantically at the little desk let into the metal wall. "This thing's locked—get his keys. Notes——"

"No." Ross shook his head groggily. "No notes—if he wrote a note it'd be out—open for us."

"If it got him he must have known why—why they died, why he was dying," Young pleaded. "He must have. Lord, Ross, he didn't lie down and drink that to see what it was."

"Maybe he did!" Ross straightened slightly, then slumped again. "No. He's the chemist. He knew. He knew what it was and why—why they died, why—we—will—die."

"He couldn't have! No, we won't die. We have to find out."

"So did he. He didn't even tell us. Didn't tell us to warn us. Why? That's another why." Ross looked at the still, frozen figure. A queer hatred was growing in his eyes, bitterness and horror, hatred and a bit of madness. Suddenly all the weight of oppression that had ridden them in the city rose again and crushed him. The comforting, shock-proof feeling of unreality was rent and cast aside. Hall did that; Hall laid his mind open to that deadly pressure of realization and reality. His lip lifted slowly, lifted and snapped down.

"Will you stop that," snapped Young. "Stop grinning, you crack-headed ape."

Ross glowered at him. "It's damned unfair of Hall. If he knew—he must have known. Why didn't he tell us? Why did he make another 'why' to bother us? Why—why——"

Young shook himself, and looked down at the figure under the shirt. It looked contorted, agonized now, because it was rigid and stiff. It should be

lying on its other side, so he grasped it abruptly and heaved it back.

Ross stalked out of the doorway. Suddenly the amplifier began to roar out a recorded storm of music, blaring forth an echoing shock of sound that shattered silence.

Young joined him in the control room. "What do we do?"

For answer, Ross' fingers flew over the controls. Behind them the slumberous atomics woke to a straining throb that drowned the roar of the speaker for a moment, then died away as vast potentials built up. A dark mantle, a trickery of unseen lenses had acted. The sphere of space about them rushed in suddenly and contracted close to them. From the port, in one single direction, Young saw the planet that had been below them, the sun that had been ahead, and all the field of stars that had been on every side. Yet they did not overlap. From every other port, he knew, he would see the same. Abruptly, the planet puffed, and vanished. The nearby sun puffed and snapped down to dwindle at crazy speed.

TENSE eyes in white face, Ross labored over his controls. The calculators hummed and clicked softly under the protecting screen of sound that kept out the clawing silence that struggled to reach them, gnawing at the walls of the ship, pressing savagely——

"We're headed back," said Ross. Slowly he straightened, then slumped forward to look at his work. Minutes passed; the record ran out, stuttered, and a new one fed itself in. White-faced, Ross looked up again, a saner terror in his eyes. Slowly that submerged as reason and courage came back. "I guess that's best, at that," he said quietly.

Young nodded vaguely. "We need help. I wouldn't stay there. That planet is *wrong*—and Hall knew why."

A light of bitterness blazed in Ross' eyes, his face set angrily. "No matter what the thing might be, he should have told."

"I wonder if it could have been a thing—that isn't tellable. An explanation that does not exist, without the lack of explanation."

Ross glared up at him. "Talk sense; stop words and make sentences."

"I mean—an hysteria. It nearly caught us. Hall was a more sensitive man than you and I; we know that. We lived with him—damn near inside his skin—in this bubble for three years. It might have been an hysteria that, mounting and growing, swept round that world and destroyed them all. Made it a morgue world without reason or sense."

Ross muttered vaguely. "It isn't sensible. Some few in any race are too utterly selfish to permit the thought of possessing all the world to be overcome by an hysteria of death. No. The misers and the antisocial would be dancing in joy. No, it doesn't explain. Hall knew. Hall knew the secret, the answer to all those 'why's', damn him. He died as all those millions did—sealing the secret forever." Ross swung abruptly, a sudden fierce flame in his face. "And listen, if you get it—get a hint of it—and don't tell me before attempting suicide—— If I find you still alive, I'll roast you slowly. I'll tear each separate nerve out of your carcass one by one. I'll——

"Hell. You tell me. That's all."

Stubbornly, Ross turned back to his controls and pecked at them as a small blue light gleamed. The light winked out. A green one lit, faded, and finally a white one lit and burned steady on the board. "We still have to eat."

ONLY THE tinyness of the star they had left indicated the motion at ten times light's speed, hours later. The stars from every port appeared the same; there was no shifting of position, no changing in constellations of the vastly

distant suns. The ship plunged on, a silent, darkened metal bubble in a silent immensity of space. The atomics were silent now, the speed-fields built to saturation. Ross stood at the port-light motionless, his eyes unseeingly staring into the strange, twisted maze of stars compressed in unnatural clarity to any line of sight.

"It must have been hysteria. It must have been. Hall would have spoken. He'd have told us, sure, if he knew and realized what struck him." Ross blurted out the words, swinging to Young.

Young looked up from his lab bench, fragments of ruby glass and a dozen drops of liquid beside his microscope. "Nothing I recognize." He sbrugged morosely. "I'm no chemist, just an inept physicist out of his field. I wouldn't know anything more complex than a few muscarine derivatives—and this is complex and new to man, I suspect. Surely we know of no such precipitation. One fragment of a drop of it solidified an egg like white lightning.

"And—it may have been hysteria. Hall was 50,000 miles in space when it got him. How many millions——" He stopped and looked at Ross with a twisted grin. "One of us will fail to reach Earth, in all probability. Stop to think of that?"

Ross looked at him in sudden suspicion. "Listen, if you get some idea of what this is all about——"

"No, damn it. But why were there three of us sent in the first place?"

"The energy concentrations needed by a larger ship couldn't be built up by known means. The atomics couldn't handle the potentials. They couldn't carry food, air, supplies for more than three men."

"Why not two men?" suggested Young smoothly.

"Why, two men——" said Ross blankly, and stopped. "Because," be went on in a suddenly tense, hard voice, "two men for three years, in a tin can, makes one man. Nerve friction, as they call it."

"Two men in a sealed tube for three years. Two men, one corpse. and one —vast—mystery. The mystery of a dead planet and a dead man. The cargo of this ship won't stay that way." Young rose and went abruptly to his room. The air recirculator cut off with a soft pop as though to emphasize his words.

For a long time Ross sat silent, listening to the creak of Young's feet on the floorplates. He began to move restlessly, bis fingers twitching slightly; then his arm. A vague uneasiness seemed to stir him. Then the unseeing lethargy seemed to drain from his eyes, a sharpening, widening horror flooding in——

He rose to his feet, and on soundless toes moved past the laboratory bench, toward the corridor leading to the rooms.

HOURS later, Young looked down into his face with a look of frozen bitterness. Ross stared back at him, his face relaxed in a gentle smile of complete satisfaction. "You damned, sneaking rat. You rotten louse. One man to operate this ship for three years—and you *knew,* you unutterable skunk, you knew. You, *you* shouting about knowing and telling, and then ducking like that——"

The cold smile on Ross' lips remained unchanged; growing wildness in Young's eyes matched the tic that formed in his cheek, jerking the muscles in little, rhythmic twitches.

He straightened slowly from the cooling corpse, and slunk down the echoing corridor of the ship, a dull hatred and hopelessness in his mind. Nightmares —nightmares of a horror planet riding in a death ship with the speed-fields up. He wouldn't dare to lower them for three full years, until they cut off of

themselves. Ross and Hall were the pilots, the ones who knew the manipulations of the speed-field finders. They had escaped, had escaped with the infinite velocity of death.

And Ross had known. Somehow, he'd guessed the secret of the planet and its dead millions, guessed it as Hall had. But what clue, what unremembered thing, had given them the path that led to understanding? And what was that understanding that drove these men, sound and safe, already trillions of miles from that world, to follow the builders of the ghost cities?

Young started at the tinkling of a falling water drop, and jabbed at the tap angrily. A sudden tinkling stream of water bubbled down and stopped. They had known—and said nothing.

And more than that—knowing, realizing that some menace hung there still, a menace they escaped by death, and death alone—Ross had taken the last few drops of that sudden poison of the death world, leaving none if he——

A cold fury settled on Young, a seething anger that cleared his mind and filled him with a determination to bring this ship, bring it back to Earth, and know the full story of the planet before he did. If, somewhere, both Hall and Ross had picked up the clue that gave them understanding, then he, too—by the gods—he, too, would find that clue!

Some understanding of possibilities came to him slowly. He moved with a swift surety to his room and gathered a few things he needed. Then, to the pilot's bench and the ship's log. Swiftly he wrote into it the account of what had passed since Ross' last entry after Hall had died. Then laboriously, he calculated many things—the exact specific heat of the ship as a whole, the energy content of the ship at 700° absolute, and studied all the ship to determine what might and might not happen.

He was a physicist and atomic engineer. Piloting this ship from the closed space of the speed-drive was beyond him; a practical knowledge he didn't have. But not the designing and building of the controls he wanted or the construction of the cylinder he would need—if things happened.

He made his connections, pressed a small switch. A tiny synchronous motor turned slowly to the low, smooth hum of a tuning fork; a slow creep of the rotary switch assured him. In twelve hours that must be reversed to halt its action.

Then he went again to the pilot room and stared unseeing at the queerly clustered stars. Slowly, every item that they had seen, had touched, went through his mind. The cold hatred for the two blankly unspeaking, yet informative corpses he suppressed; they told him only this—that it could be known. It could be, knowing the why of those dead millions the reason for that suicide, the nature of the cosmic menace that had overcome them so utterly that they, the supreme fighting type of their world, had gone down unresisting. And that, somehow, that knowledge impelled a bond of final secrecy.

IT CAME to him with sudden surprise, the numbness of his hand. The faint ticking of his finger nails in the startled silence of the ship brought a slow fading of that intense concentration. Idly at first he rubbed the numbed hand to restore circulation—and paused.

A tremor shook him, and a shocked horror flooded his mind. A million voices shouted and commanded deep within him, a growing clamor that was, somehow, united and fiercely determined. A conscious force growing discoverable abruptly, noticed for the first time——

It seemed, then, to take long minutes of slow growth, yet in the confusion he knew simultaneously that it was like the

time-rate of a dream, started by the slam of a door, ending with the slam of the door as the closing sequence of the dream. A flash of mental action of incredible rapidity vouchsafed him in the infinitesimal instant of time between his awareness of attack, and his defeat.

In that atom of time, he saw through other minds, a million billion other minds, and yet thought with his own. He lived in another universe, a universe of infinitesimals, thinking, conscious, intelligent molecules. Single molecules of a vast complexity driving forward to a racial goal through the medium of countless billions of keen-thinking units—units that were single, conscious molecules. What body cells were to Young, single atoms were to them. Their thought was a swift shifting of atomic strains within their molecule-bodies; their senses not sight, nor sound, nor any thing humans might know, but finer, subtler things of electric, magnetic, gravitic strains. A fineness that made chemical action a stupendous, gross thing.

Light came to them as great blundering, fuzzy balls of energy which they absorbed as food. Their thought processes flashing with the speed of electric stress, outstripped man's clumsy mechanism a million times. Yet one great thing they lacked; they could have no control of gross matter, their very minuteness made that thing to them unthinkable. A hundred million atoms composed each molecule-body. A vastly swollen, intelligent molecule—yet withal so minute that a hundred millions of them were indetectable to man.

INTELLIGENCE, swift, keen intelligence—unable to control their own environment by the handicap of size. Yet, eating the hurtling quanta of light and radiant heat as food, they could ride the streaming light-currents of space from world to world. For temperature was unknown to them, light, food enough. Only the extreme battering of high-temperature molecules could destroy them. Beyond that one thing, their conscious control of their own molecular forces made them immune, eternal.

But the delicate, immensely organized chemistry of intelligent beings like man were susceptible to the race control of billions of them. Immense organizations of them, working in planned unison, could affect the delicate chemistry of nerves and brain to give orders, relayed by the grosser, greater organism into action that could control that physical environment beyond their own control.

And, like many high protein molecules, they had this other attribute; they were, chemically, enzymatic. They could force lesser, unconscious proteins that to them appeared as lesser animals, to shape and form themselves into replicas of the Intelligences. Man would serve them both as breeding ground, and relay control, subjected utterly to the unseen will of beings whose smallness put them beyond the greatest microscope.

An understanding that swept up and through Young's mind in that last instant of consciousness, before his mind fell before their final comprehension of the intricate network of nerve cells that long study, since first they entered his body on the dead world, had brought.

And Young understood, too, the suicides, the preservation that Ross had puzzled at. The red-flask poison the Intelligences knew, and hated. A lesser, swifter enzyme protein that shook down the proteins of man, or any protenious material to its own form. One that destroyed equally the protein molecule that had gained intelligence. The injected stuff, a simple chemical poison, that, like formaldehyde, precipitated and hardened any protein, rendering the dead flesh forever useless to the Intelligences.

His body surged up from its chair as

a last fierce urge whipped through him before the rising tide of molecules destroyed his last conscious will. The familiar control room, the lab bench, reeled and faded behind red mist in the same instant that he rose. His mind had fallen to the planned attack of a billion unseen enemies, seeking through him to gain control of all space, for all time——

The dark mist faded very slowly from his eyes. Before he could see, even, he knew where he would find himself. His eyes opened on the metal walls of his own cabin, familiar things seen through a slow growing haze. A warm lethargy that had crept into legs and arms, was creeping inward to this last core that was himself. Fading memory and knowledge gained from the attackers made it clear; their greater, more complex molecules fell easier prey to the enzyme poison of the Planet of Death. For this last, brief second of time before it finally overcame him, too, in its warm lethargy, he understood.

Already the warm paralysis had reached, and stopped his motor nerves; he could not speak, or write, or signal now, just as before him Hall and then Ross had been helpless to warn, or explain.

THE LAST brief flash of action though, had gone unstayed, for the yet more complex paths of his subconscious mind had not so easily been traced. Unhampered, it had carried out his last strong will. The last drop of poison Ross had taken, but the egg—— Dimly he saw it, half eaten, beyond the growing haze of warm grey before his closing eyes.

And memory satisfied him of other things. The log, with a scrawled warning "Intelligent molecules——" that he had thrust in self-hypnosis in the prepared, heat-proof cylinder. The synchronous motor turning slow before the drive of a humming tuning fork that molecules could not halt.

The circuit would close, the automatic controls would bring the ship to Earth's system, and halt it as the speed-fields collapsed. And slowly, because of that closed circuit, the atomics would labor and build up a temperature of 700° absolute, where metal glowed dull and warning red——

And destroyed any molecule save only the very simplest, even those that might be partly sheltered in the asbestos cylinder, where even paper would be somewhat scorched——

Power Plants of To-morrow

by Willy Ley

The first of a short series on the sources of to-morrow's energy

Harnessing The Sun's Rays

IT WAS a somewhat curious situation, this session of the French Academy of Sciences in Paris, in 1929, when Professor Bernard Dubos lectured on Solar Power Plants. Several hundred eyes, belonging to calm and serious scientists, were staring at the lecturer's desk. Dubos silently took a match from the desk drawer and solemnly ignited the wick of a tiny alcohol burner. The little bluish flame flickered; slowly it heated a sheet of metal placed a few inches above the burner. About two feet over the metal plate a small propeller was mounted horizontally.

Four hundred eyes stared in apprehension.

Nothing happened!

Then Dubos picked up a strange contraption made of sheet metal. It looked somewhat like a flat box without cover. A metal tube was fastened to a hole in its bottom. The whole thing could be likened to a queerly shaped funnel. Dubos turned the funnel around and placed it upside down on the metal plate, the mouth of the funnel being directly underneath the horizontally mounted propeller. Instantly then the propeller started to rotate at high speed. It stopped as soon as the funnel was removed. It began again as soon as it was placed again on top of the hot sheet metal.

"And this, messieurs," Dubos said, "is the only way to harness solar energy."

One may accuse the French Academy of Science of being too conservative. One may remember that the learned society refused to believe in the evidence for meteorites, that it doubted the findings of Pasteur, that it did not believe Edison when he demonstrated his first phonograph. But this time it was readily convinced that Dubos' solar engine was feasible and that it was conceived on sound principles.

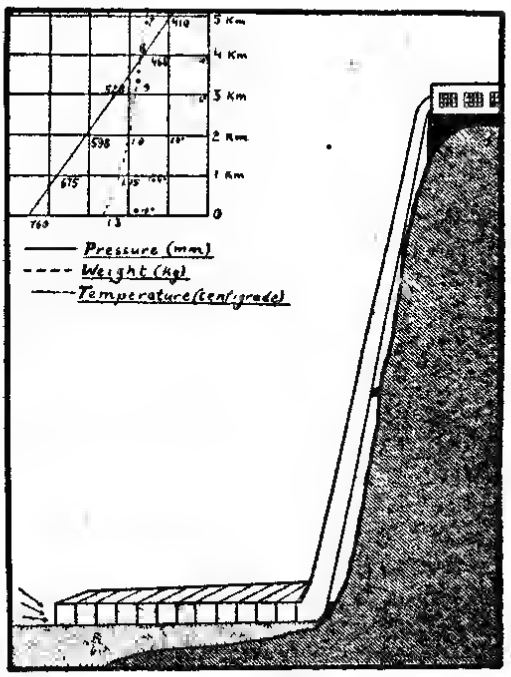
The tiny alcohol burner of Dubos' model represented the heat of the Sun's rays; the sheet metal represented a hot plain; the propeller represented a wind turbine and the two-feet distance the height of a mountain near the plain. The funnel-shaped device was the real invention; it was an entirely new idea for a solar power plant.

Solar power plants are no novelty. The wish to harness the enormous energy of the Sun's rays seems to be quite old. It is, of course, uncertain whether Archimedes actually burned the Roman fleet off Syracuse by means of parabolic mirrors, in 212 B. C., but if he did his device was the first solar engine. Another solar motor, operating a small fountain, is reported from the year 1600. It consisted of a metal water container equipped with a number of convex lenses on one side. If the container was placed in the Sun the lenses condensed

enough rays to keep the water slowly boiling. Thus the necessary pressure for the fountain was furnished. The first solar engine in the United States was probably the one built by John Ericsson who lived in New York State in 1870. Ericsson seems to have been pretty successful with his machines, because he built not less than seven of them in 1875.

The largest solar power plant in existence is the one near Meadi, in Egypt. It consists of several dozen large, troughlike paraboloid mirrors which heat a fluid confined in pipes that form the focal lines of these mirrors. The steam thus generated drives an engine which, in turn, drives a pump which pumps water into the irrigation canals of near-by cotton fields.

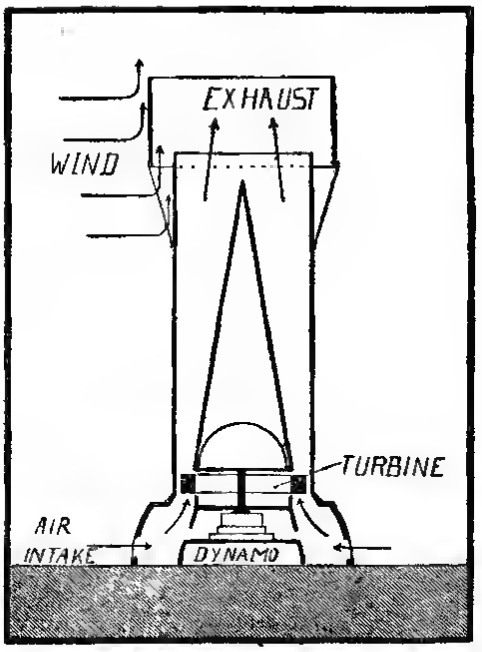
Although this power plant has served its purpose—and served it well—for quite a number of years, it is by no means ideal. The whole apparatus is costly, clumsy, fragile and inefficient. It was commercially possible only because coal was extremely expensive in Egypt at the time when it was built.



Dubos' plan of indirect utilization of solar heat based on the "chimney effect." The graph shows variation of air pressure and relative density with altitude.

Professor Bernard Dubos had studied the problem of harnessing solar energy for many years before he delivered his famous lecture. He had studied the steadily increasing energy demands of civilization. He knew that the natural resources were dwindling rapidly. At the World Congress of Geologists, in 1913, it had been estimated that there would be no coal left in about a thousand years. In England and in Germany the resources would last only for about 200 years; in America for a little over 1500 years; in other countries for even shorter periods of time. This statement had been called pessimistic by others, because there are certainly still large unknown coal deposits in Africa, Asia and possibly on the Antarctic Continent. On the other hand, the demand for power had increased much more rapidly than it had been thought. It appeared probable that the World Congress of Geologists had even been optimistic.

The quantity of coal mined at the time when Dubos spoke represented about 250,000,000 h.p. This was not enough. Water power had to help supply the demand. There are about 450,000,000 h.p. in the waterfalls of our globe. But 190,000,000 of these 450,000,000 are located in Inner Africa, where, at least at present, nobody needs them. Another 70,000,000 are located in Inner Asia. It is obvious that water power may help to furnish the power needed, but it cannot solve the problem. One remembers the words of Charles P. Steinmetz: "If all the potential water power of the country (U.S.A.) were now developed, and every raindrop used, it would not support our present energy demand." The situation grows worse



if one considers automobiles and airplanes. There are another 300,000,000 h.p. that want to be fed. And there is no way of telling how they will multiply.

An estimate which has to be called conservative says that 1,000,000,000 h.p. will yell for fuel in 1970. Another 1,000,000,000 h.p. in automobiles, airplanes and ships is to be added to this figure. In 1970 there will be hardly any natural oil left and the coal deposits will probably be reserved for the chemical industries that need them much more badly than anybody else. In short, the situation is serious. New sources of power will have to be found and exploited to the utmost.

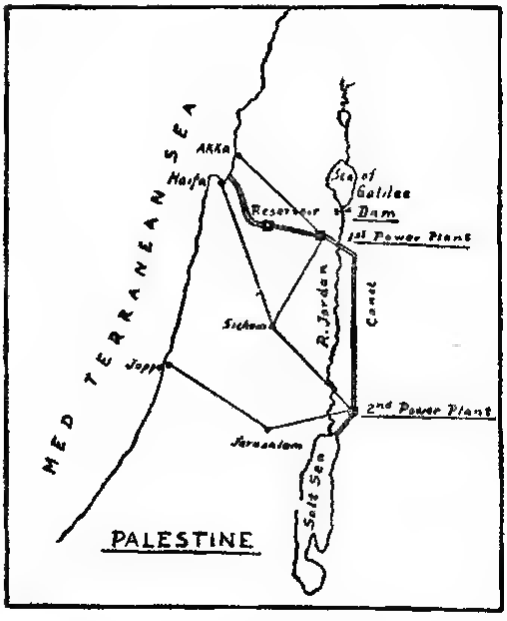
In this connection the energy of the Sun's rays is especially tempting. In Egypt every square foot of land receives 3245 B.T.U. per minute, 214,000,000 h.p. per square mile. It seems to be an astounding bounty, free for the taking. But these contraptions of mirrors, boilers, condensers, storage tanks and steam engines are unable to take more than an almost invisible percentage of it.

Thus Professor Dubos could say: "It is senseless to build mirrors and all the paraphernalia of solar power plants of the existing type. The result would be that 50 h.p. are generated on an area of 20 acres, which is ridiculous." The main reason for this ridiculously low efficiency has to be sought in the large number of parts and units that constitute a solar power plant. Neither mirrors, nor boilers, nor steam pipes, nor steam engines, nor pumps, work without losses, and on the way from one to the other of these parts there are a hundred minor leaks and flaws that help to decrease the final result. To be really efficient a solar power plant should consist of very few parts—preferably not even moving parts.

Professor Dubos' model is, therefore, an excellent solution of the problem in question. The principles applied in his invention are very simple, although they are of secondary nature. Dubos does not try to utilize the heat of the Sun's rays directly, since this has proven to be extremely difficult. His power plant utilizes the fact that air on a hot plain, say an African desert, is hotter and denser than that one or two miles above the plain.

Actual measurements show that there is a different of pressure of not less than 6.5 inches of mercury between sea level and 6500 feet altitude. It it were possible to build a large chimney, 6000 feet high, on such a plain, the "compressed" air at set level would try to escape through it. It would rise upward in the chimney with a speed about three times as fast as that of the strongest natural cyclones.

Such a chimney is a technical impossibility, if one thinks of it as standing free. But Dubos does not propose a free-standing chimney, even though his demonstration before the French Academy of Sciences may suggest the thought. He thinks of a long tube leaning against a steep mountain slope. The wind tube is to have a diameter of about



35 feet. At its bottom it is to flare out into a glass roof like that of a large hothouse, so that additional heat is built up. Since it is essential that the air, while rushing upward in the tube, does not lose much of its heat, the tube should not be constructed of metal. Light concrete suggests itself, therefore, because it has all the features desired: heat-insulating properties, low price, light weight and sufficient resistance.

Dubos' invention is not only amazingly simple, it also has the advantage of being easy to construct. There are no technical difficulties at all involved in the construction of wind tube and glass roof. One might only say that wind turbines of the size and of the capacity needed have not been built before. Unfortunately, the invention is not generally applicable. It assumes a mountain of medium height in the immediate vicinity of a deep-lying hot plain.

But these conditions prevail on many parts of the Earth where electric power would be welcome; Dubos himself thought principally of the Atlas Mountains in North Africa.

The session of the French Academy of Sciences ended with unanimous approval of Dubos' ideas and a recommendation of his plans as a feasible means to harness solar power.

However, solar power plants suffer from an inherent flaw. They do not work at night, when the demand is usually higher than during the day. Some form of storage must be used to avoid this difficulty. Dr. Charles G. Abbott, secretary of the Smithsonian Institution, who is at present the most famous inventor of solar engines in the United States, used oil in one of his earlier models for this purpose, because it boils at a higher temperature and retains heat longer than water. This "solar cooker" as he called it, consisted of a troughlike paraboloidal mirror like the mirrors used near Meadi, Egypt. Cold oil was brought from a reservoir through a pipe under the mirror. It returned through another pipe placed in the focal line of the mirror. There was no pump necessary, because the hot oil rose automatically. It attained a temperature of about 175° C. (375° F.) which was sufficient to heat two cooking ovens placed in the oil reservoir. The oil stored sufficient heat so that the ovens could be used at any time during day or night.

It seems that the Russian scientists that were operating a kitchen, a bath and a water tower by means of solar heat, near Tashkent, the capital of the Uzbek Soviet Republic of Central Asia, used a system very similar to the one applied by Dr. Abbott. Two years ago the Russians announced the erection of a solar power plant of 30,000 kilowatts capacity, near Tashkent. But since then nobody heard anything about this power plant which would have been the largest of its type.

Meanwhile, another plan to harness solar energy had been developed in France, by Pierre Gandrillon. At first glance one is tempted to declare that Gandrillon's interesting project has nothing to do with solar energy, be-

cause it looks even less than Dubos' tube like the customary type of mirror-equipped solar engines we are accustomed to remember whenever the words " solar energy" or "solar power" are used.

Gandrillon's project, which is adapted to the geographical conditions of the Holy Land, seems to be a normal water power plant. But much sunshine is needed to keep it running. The water that passes through the turbines has to disappear somehow, and rapid evaporization is the best way to make it disappear.

The project is based on the fact that the valley of the River Jordan is far below the level of the Mediterranean Sea. There is a level difference of 208 meters between the Mediterranean Sea and the Sea of Galilee and a difference of almost twice as much (394 meters) between the Mediterranean Sea and the Salt Sea or Dead Sea The distance of the Sea of Galilee from the shore of the Mediterranean Sea is about 50 kilometers; the highest point on a carefully planned route is about 80 meters above the level of the Mediterranean Sea, situated 20 kilometers from its shore.

At, or near, this point Gandrillon plans a reservoir of sufficient size which is to be filled with water from the Mediterranean. Of course, it takes power to pump the water 80 meters high, but from there to the Jordan Valley, a drop of almost 300 meters, can be utilized, so that a considerable gain in power is the result. Gandrillon then wants to conduct this water through a straight canal, which follows the route of the River Jordan. Near the Salt Sea another drop of about 180 meters can be utilized. Finally, the water flows into the Dead Sea, to be evaporized by the Sun, so that the Dead Sea always furnishes room for new water coming from the Mediterranean.

Gandrillon's plan is doubtlessly possible and does not involve a single new engineering problem. Without raising the level of the Dead Sea his power plants could furnish 20,000 h.p., which is rather unimportant. Therefore, Gandrillon thinks of damming the River Jordan at the point where it leaves the Sea of Galilee. Then this sea would increase in size, which would benefit agriculture in the regions around it, especially if an irrigation system of sufficient magnitude is developed. The power plants could then receive an additional amount of water from the Mediterranean, equal in volume to the River Jordan. Even if the level of the Salt Sea should rise somewhat it would not do any harm. Therefore, Gandrillon does not hesitate to promise that the two power plants will have a capacity of 250,000 h.p if needed.

It may be added that the Jordan Valley is not the only valley on Earth where conditions are favorable for power plants following Gandrillon's scheme.

The problem of harnessing solar power has much similarity with the problem of extracting the gold dissolved in the water of the oceans. It does not help us to know that every cubic mile of ocean water contains so and so many tons of gold. And it does not help us to know that the State of New Mexico receives a hundred times as much solar energy per year than is consumed from other sources in all North America during the same time. Neither the gold nor the solar radiation are accessible, and our methods are much too clumsy to be efficient. But while we can live without the gold of the seas, we cannot live without power. And Gandrillon's suggestion, as well as Dubos' invention, will help to furnish at least some of the many horsepower hours required by civilization in the near future.

The second article in this series: "Harnessing the Earth's Heat" will appear in the next issue.

Pithecanthropus Rejectus

by

Manly W. Wellman

"I gave you the mind, hands and speech—of man. Now you——"

MY first memories seem to be those of the normal human child—nursery, toys, adults seriously making meaningless observations with charts, tape measures and scales. Well, rather more than average of that last item, the observations. My constant companion was a fat, blue-eyed baby that drooled and gurgled and barely crept upon the nursery linoleum, while I scurried easily hither and thither, scrambling up on tables and bedposts, and sometimes on the bureau. I felt sorry for him now and then. But he was amazingly happy and healthy, and gave no evidence of having the sudden fearful pains that struck me in head and jaw from time to time.

As I learned to speak and to comprehend, I found out the cause of those pains. I was told by the tall, smiling blond woman who taught me to call her "Mother." She explained that I had been born with no opening in the top of my skull—so needed for bone and brain expansion—and that the man of the house—"Doctor"—had made such an opening, governing the growth of my cranium and later stopping the hole with a silver plate. My jaw, too, had been altered with silver, for when I was born it had been too shallow and narrow to give my tongue play. The building of a chin for me and the remodeling of several tongue-muscles had made it possible for me to speak. I learned before the baby did, by several months. I learned to say Mother, Doctor, to call the baby "Sidney" and myself "Congo." Later I could make my wants known although, as this writing shows and will show, I was never fluent.

Doctor used to come into the nursery and make notes by the hour, watching my every move and pricking up his ears at my every sound. He was a stout, high-shouldered man, with a strong, square beard. He acted grave—almost stern—where I was involved. But with baby Sidney he played most tenderly. I used to feel hurt and would go to Mother for sympathy. She had enough for me and Sidney, too. She would pick me up and cuddle me and laugh—give me her cheek to kiss.

Once or twice Doctor scowled, and once I overheard him talking to Mother just beyond the nursery door. I understood pretty well even then, and since that time I have filled in details of the conversation.

"I tell you, I don't like it," he snapped. "Showering attentions on that creature."

She gave him a ready laugh. "Poor little Congo!"

"Congo's an ape, for all my surgery," he replied coldly. "Sidney is your son,

Already the old dream was reality, and the civilization I had known was slipping away——

and Sidney alone. The other is an experiment—like a shake-up of chemicals in a tube, or a grafting of twigs on a tree."

"Let me remind you," said Mother, still good-natured, "that when you brought him from the zoo, you said he must live here as a human child, on equal terms with Sidney. That, remember, was part of the experiment. And so are affection and companionship."

"Ah, the little beast!" Doctor almost snarled. "Sometimes I wish I hadn't begun these observations."

"But you have. You increased his brain powers and made it possible for him to speak. He's brighter than any human child his age."

"Apes mature quickly. He'll come to the peak of development and Sidney will forge ahead. That always happens in these experiments."

"These experiments have always been performed with ordinary ape-children before," said Mother. "With your operations you've given him something, at least, of human character. So give him something of human consideration as well."

"I'm like Prospero, going out of my way to lift up Caliban from the brute."

"Caliban meant well," Mother responded, reminding him of something I knew nothing about. "Meanwhile, I don't do things by halves, dear. As long as Congo remains in this house, he shall have kindness and help from me. And he shall look to me as his mother."

I heard and, in time, digested all of this. When I learned to read, during my third year, I got hold of some of Doctor's published articles about me and began to realize what everything meant.

Of course, I'd seen myself in mirrors hundreds of times and knew that I was dark, bow-legged and long-armed, with a face that grew out at an acute angle, and hair all over my body. Yet this had not set me very far apart, in my own mind, from the others. I was different from Sidney—but so was Doctor and so was Mother, in appearance, size and behavior. I was closer to them—in speech and such things as table manners and self-reliance—than he. But now I learned and grew to appreciate the difference between me, on one side, and Sidney, Doctor and Mother on the other.

I HAD been born, I found, in an iron cage at the Bronx Zoo. My mother was a great ape, a Kulakamba, very close to human type in body, size and intelligence—not dwarfed like a common chimpanzee nor thickset and surly like a gorilla. Doctor, a great experimental anthropologist—words like those happen to be easy for me, since they were part of daily talk at Doctor's house—had decided to make observations on a baby ape and his own newborn child, rearing them side by side under identical conditions. I was the baby ape.

Incidentally, I have read in a book called "Trader Horn" that there are no Kulakambas, that they are only a fairy story. But there are—many and many of us, in the Central African forests.

I tell these things very glibly, as if I knew all about them. Doctor had written reams about the Kulakamba, and clippings of all he wrote were kept in the library. I had recourse to them as I grew older.

When I was four, Doctor led me into his big white laboratory. There he examined and measured my hands, grunting perplexedly into his beard.

"We'll have to operate," he said at last.

"Will we?" I quavered. I knew what the word meant.

He smiled, but not exactly cheerfully. "You'll have an anesthetic," he promised, as though it were a great favor. "I want to fix your hands. The thumbs don't oppose and it makes your grasp clumsy. Not human, Congo; not human."

I was frightened, but Mother came to comfort me and say that I would be better off in the long run. So, when Doctor commanded, I lay on the sheet-spread table and breathed hard into the cloth he put on my face. I went to sleep and dreamed of high, green trees and of people like myself who climbed and played there—building nests and eating nuts as big as my head. In my dream I tried to join them, but found myself held back, as if by a pane of glass. That made me shed tears—though some say that apes cannot shed tears—and thus

weeping, I awoke. My hands had a dull soreness in them and were swathed in bandages to the elbows. After weeks, I could use them again and found that their calloused palms had been softened, the awkward little thumbs somehow lengthened and newly jointed. I grew so skillful with them that I could pick up a pin or tie a bow knot. This was in the winter time, and once or twice when I played on the porch I had terrible pains in brow and jaw. Doctor said that the cold made my silver plates hurt, and that I must never go outside without a warm cap and a muffler wrapped high.

"It's like a filling against the nerve of a tooth," he explained.

At seven I was all about the house, helping Mother very deftly with her work. Now Doctor grew enthusiastic about me. He would lecture us all at the table—Sidney and I ate with him when there was no company—and said that his experiment, faulty in some ways, gave promise of great things along an unforeseen line.

"Congo was only a normal ape-cub," he would insist, "and he's developing in every possible way into a very respectable lower-class human being."

"He's by no means lower-class," Mother always argued at this point, but Doctor would plunge ahead.

"We could operate on his people wholesale, make wonderful, cheap labor available. Why, when Congo grows up he'll be as strong as six or eight men, and his keep is almost nothing."

HE TESTED me at various occupations—gardening, carpentry and ironworking, at which last I seem to have done quite well—and one day he asked me what I would rather do than anything else.

I remembered the dream I had had when he operated on me—and many times since. "Best of all," I replied, "I would like to live in a tree, build a nest of leaves and branches——"

"Ugh!" he almost screamed in disgust. "And I thought you were becoming human!"

After that he renewed his demands that Mother treat me with less affection.

Sidney was going to school at this time. I remained at home with Doctor and Mother—we lived in a small New Jersey town—and confined most of my activities to the house and the shrub-grown back yard. Once I ran away, after a little quarrel with Doctor, and frightened the entire neighborhood before I was brought back by a nervous policeman with a drawn revolver. Doctor punished me by confining me to my room for three days. During that lonely time I did a lot of thinking and set myself down as an outcast. I had been considered strange, fearful and altogether unbelonging, by human beings. My crooked body and hairy skin had betrayed me to enmity and capture.

At the age of ten I gained my full growth. I was five feet six inches tall and weighed as much as Doctor. My face, once pallid, had become quite black, with bearded jaws and bristly hair on the upper lip. I walked upright, without touching my knuckles to the ground as ordinary apes do, for I usually held some tool or book in my hands. By listening to Sidney as he studied aloud at night I got some smattering of schooling, and I built upon this by constant and serious reading of his discarded textbooks. I have been told that the average shut-in child is apt to do the same. On top of this, I read a great deal in Doctor's library, especially travel. But I disliked fiction.

"Why should I read it?" I asked Mother when she offered me a book about "Tom Sawyer." "It isn't true."

"It's interesting," she said.

"But if it's not true, it's a lie; and a lie is wicked."

She pointed out that novel-readers knew all the time that the books were

not true. To that I made answer that novel-readers were fools. Doctor, joining the conversation, asked me why, then, I enjoyed my dreams.

"You say that you dream of great green forests," he reminded. "That's no more true than the books."

"If it is a good dream," I replied, "I am glad when I wake, because it made me happy. If it is a bad dream, I am glad because I escape by waking. Anyway, dreams happen and novels do not."

Doctor called it a *sophistication,* and let that conclude the argument.

I have said that I am no proper writer, and I have shown it by overlooking an important fact—the many visits of scientists. They came to observe and to discuss things with Doctor, and even with me. But one day some men appeared who were not scientists. They smoked long cigars and wore diamond rings and derby hats. Doctor had them in his study for an hour, and that night he talked long to Mother.

"Eighteen thousand dollars!" he kept saying. "Think of it!"

"You've never thought of money before," she said sadly.

"But eighteen th—my dear, it would be only the beginning. We'd do the experiment again, with two baby apes—two new little Congos for you to fuss over——"

"And the first Congo, my poor jungle foster son," mourned Mother. "He'd be miserable somewhere. How can you think of such a thing, dear? Didn't your grandfather fight to free slaves in his day?"

"Those were human slaves," replied Doctor. "Not animals. And Congo won't be miserable. His ape-instinct will enjoy the new life. It'll fairly glitter for him. And we need the money to live on and to experiment with."

THAT went on and on, and Mother cried. But Doctor had his way. In the morning the men with the cigars came back, and Doctor greeted them gayly. They gave him a check—a big one, for they wrote it very reverently. Then he called me.

"Congo," he said, "you're to go with these people. You've got a career now, my boy; you're in the show business."

I did not want to go, but I had to.

My adventures as a theatrical curiosity have been described in many newspapers all over the world, and I will mention them but briefly. First I was rehearsed to do feats of strength and finish the act with alleged comedy—a dialogue between myself and a man in clown costume. After that, a more successful turn was evolved for me, wherein I was on the stage alone. I performed on a trapeze and a bicycle, then told my life story and answered questions asked by the audiences. I worked in a motion picture, too, with a former swimming champion. I liked him on sight, as much as I liked any human being except Mother. He was always kind and understanding, and did not hate me, even when we were given equal billing.

For a while many newspaper reporters thought I was a fake—a man dressed up in a fur suit—but that was easily disproven. A number of scientists came to visit me in the various cities I performed in, and literally millions of curious people. In my third year as a showpiece I went to Europe. I had to learn French and German, or enough to make myself understood on the stage, and got laughed at for my accent, which was not very good. Once or twice I was threatened, because I said something in the theaters about this political leader or that, but for the most part people were very friendly.

Finally, however, I got a bad cough. My owners were fearfully worried and called a doctor, who prescribed a sea voyage. Lots of publicity came of the announcement that I would sail south, to "visit my homeland of Africa."

Of course I had not been born in

Africa, but in the Bronx Zoo; yet a thrill came into my heart when, draped in a long coat and leaning on the rail, we sighted the west coast just below the Equator.

That night, as the ship rode at anchor near some little port, I contrived to slip overside and into a barge full of packing cases. I rode with it to land and sneaked out upon the dock, through the shabby little town, and away up a little stream that led into a hot, green forest.

I tell it so briefly and calmly because that is the way the impulse came to me. I read somewhere about the lemmings, the little ratlike animals that go to the sea and drown themselves by the thousands. That is because they must. I doubt if they philosophize about it; they simply do it. Something like that dragged me ashore in Africa and up the watercourse.

I was as strange and awkward there as any human being would be for the first time. But I knew, somehow, that nature would provide the right things. In the morning I rested in a thicket of fruit trees. The fruit I did not know, but the birds had pecked at it, so I knew it was safe for eating. The flavor was strange but good. By the second day I was well beyond civilization. I slept that night in a tree, making a sort of nest there. It was clumsy work, but something beyond my experience seemed to guide my hands.

After more days, I found my people, the Kulakambas.

THEY were as they had been in the dream, swinging in treetops, playing and gathering food. Some of the younger ones scampered through the branches, shrilling joyfully over their game of tag. They talked, young and old—they had a language, with inflections and words and probably grammar. I could see a little village of nests, in the forks of the big trees; well-made shelters, with roofs over them. Those must have been quickly and easily made. Nothing troubled the Kulakambas. They lived without thought or worry for the next moment. When the next moment came they lived that, too.

I thought I would approach. I would make friends, learn their ways and their speech. Then I might teach them useful things, and in turn they would teach me games. Already the old dream was a reality and the civilization I had known was slipping away—like a garment that had fitted too loosely.

I approached and came into view. They saw, and began to chatter at me. I tried to imitate their sounds, and I failed.

Then they grew excited and climbed along in the trees above me. They began dropping branches and fruits and such things. I ran, and they followed, shrieking in a rage that had come upon them from nowhere and for no reason I could think of. They chased me all that day, until nightfall. A leopard frightened them then, and me as well.

I returned, after many days, to the town by the sea. My owners were there, and greeted me with loud abuse. I had cost them money and worry, important in the order named. One of them wanted to beat me with a whip. I reminded him that I could tear him apart like a roast chicken and there was no more talk of whipping me. I was kept shut up, however, until our ship came back and took us aboard.

Nevertheless, the adventure turned out well, so far as my owners were concerned. Reporters interviewed me when I got back to London. I told them the solemn truth about what I had done, and they made publicity marvels out of the ape-man's return to the jungle.

I made a personal appearance with my picture, for it had come to England just at that time. A week or so later came a cable from America. Somebody was reviving the plays of William

Shakespeare, and I was badly wanted for an important rôle. We sailed back, were interviewed by a battery of reporters on landing, and went to an uptown hotel. Once or twice before there had been trouble about my staying in hotels. Now I was known and publicized as a Shakespearean actor, and the management of the biggest and most sumptuous hotel was glad to have me for a guest.

At once my owners signed a contract for me to appear in "The Tempest." The part given me to study was that of Caliban, a sort of monster who was presented as the uncouth, unwelcome villain. Part of the time he had to be wicked, and part of the time ridiculous. As I read of his fumblings and blunderings, I forgot my long-held dislike of fiction and fable. I remembered what Doctor and Mother had said about Caliban, and all at once I knew how the poor whelp of Sycorax felt.

THE next day a visitor came. It was Doctor.

He was grayer than when I had seen him, but healthy and happy and rich-looking. His beard was trimmed to a point instead of square, and he had white edging on his vest. He shook my hand and acted glad to see me.

"You're a real success, Congo," he said over and over again. "I told you that you'd be." We talked a while over this and that, and after a few minutes my owners left the room to do some business or other. Then Doctor leaned forward and patted my knee.

"I say, Congo," he grinned, "how would you like to have some brothers and sisters?"

I did not understand him, and I said so.

"Oh, perfectly simple," he made reply, crossing his legs. "There are going to be more like you."

"More Kulakambas?"

He nodded. "Yes. With brains to think with, and jaws to talk with. You've been a success, I say—profitable, fascinating. And my next experiment will be even better, more accurate. Then others—each a valuable property—each an advance in surgery and psychology over the last."

"Don't do it, Doctor," I said all at once.

"Don't do it?" he repeated sharply. "Why not?"

I tried to think of something compelling to reply, but nothing came to mind. I just said, "Don't do it, Doctor," as I had already.

He studied me a moment, with narrow eyes, then he snorted just as he had in the old days. "You're going to say it's cruel, I suppose," he sneered at me.

"That is right. It is cruel."

"Why, you——" He broke off without calling me anything, but I could feel his scorn, like a hot light upon me. "I suppose you know that if I hadn't done what I did to you, you'd be just a monkey scratching yourself."

I remembered the Kulakambas, happy and thoughtless in the wilderness.

He went on, "I gave you a mind and hands and speech, the three things that make up a man. Now you——"

"Yes," I interrupted again, for I remembered what I had been reading about Caliban. "Speech enough to curse you."

He uncrossed his legs. "A moment ago you were begging me not to do something."

"I'll beg again, Doctor," I pleaded, pushing my anger back into myself. "Don't butcher more beasts into—what I am."

He looked past me, and when he spoke it was not to me, but to himself. "I'll operate on five at first, ten the next year, and maybe get some assistants to do even more. In six or eight years there'll

be a full hundred like you, or more advanced——"

"You mustn't," I said very firmly, and leaned forward in my turn.

He jumped up. "You forget yourself, Congo," he growled. "I'm not used to the word 'mustn't'—especially from a thing that owes me so much. And especially when I will lighten the labor of mankind."

"By laying mankind's labor on poor beasts."

"What are you going to do about it?" he flung out.

"I will prevent you," I promised.

He laughed. "You can't. All these gifts of yours mean nothing. You have a flexible tongue, a rational brain—but you're a beast by law and by nature. I," and he thumbed his chest, "am a great scientist. You can't make a stand of any kind."

"I will prevent you," I said again, and I got up slowly.

He understood then, and yelled loudly. I heard an answering cry in the hall outside. He ran for the door, but I caught him. I remember how easily his neck broke in my hands. Just like a carrot.

The police came and got me, with guns and gas bombs and chains. I was taken to a jail and locked in the strongest cell, with iron bars all around. Outside some police officials and an attorney or two talked.

"He can't be tried for murder," said some one. "He's only an animal, and not subject to human laws."

"He was aware of what he did," argued a policeman. "He's as guilty as the devil."

"But we can hardly bring him into court," replied one of the attorneys. "Why, the newspapers would kid us clear out of the country—out of the legal profession."

They puzzled for a moment, all together. Then one of the police officers slapped his knee. "I've got it," he said, and they all looked at him hopefully.

"Why talk about trials?" demanded the inspired one. "If he can't be tried for killing that medic, neither can we be tried for killing him."

"Not if we do it painlessly," seconded some one.

They saw I was listening, and moved away and talked softly for a full quarter of an hour. Then they all nodded their heads as if agreeing on something. One police captain, fat and white-haired, came to the bars of my cell and looked through.

"Any last thing you'd like to have?" he asked me, not at all unkindly.

I asked for pen and ink and paper, and time enough to write this.

RED HERITAGE

by

John Russell Fearn

A planet-trap lay baited for a cosmic thief—milleniums it waited——

THERE can be no doubt about it —our world is dying!"

Kil-Dio, the Venusian, uttered the words in the scraping diction that was his equivalent of language. His stalked eyes traveled solemnly over the assembly of five thousand Venusians filling the great columned administrative hall. Like him, they were all sluglike —nauseous-looking, dirty-gray creatures, propelled by a group of powerful feelers, with arms that were mere extensions of their bodies. But the Venusians were not merely intelligent—they were superscientists, confronted now with the greatest problem they had yet been called upon to master.

"We are faced with a defunct world unless we resort to theft," Kil-Dio went on, quietly. "It is a grievous slur on the nobility of science that we should be compelled to rob another world in order to rejuvenate our own—but I foresee no other way." His stalked eyes turned from the assembly and looked in silent eloquence through the broad, floor-length window.

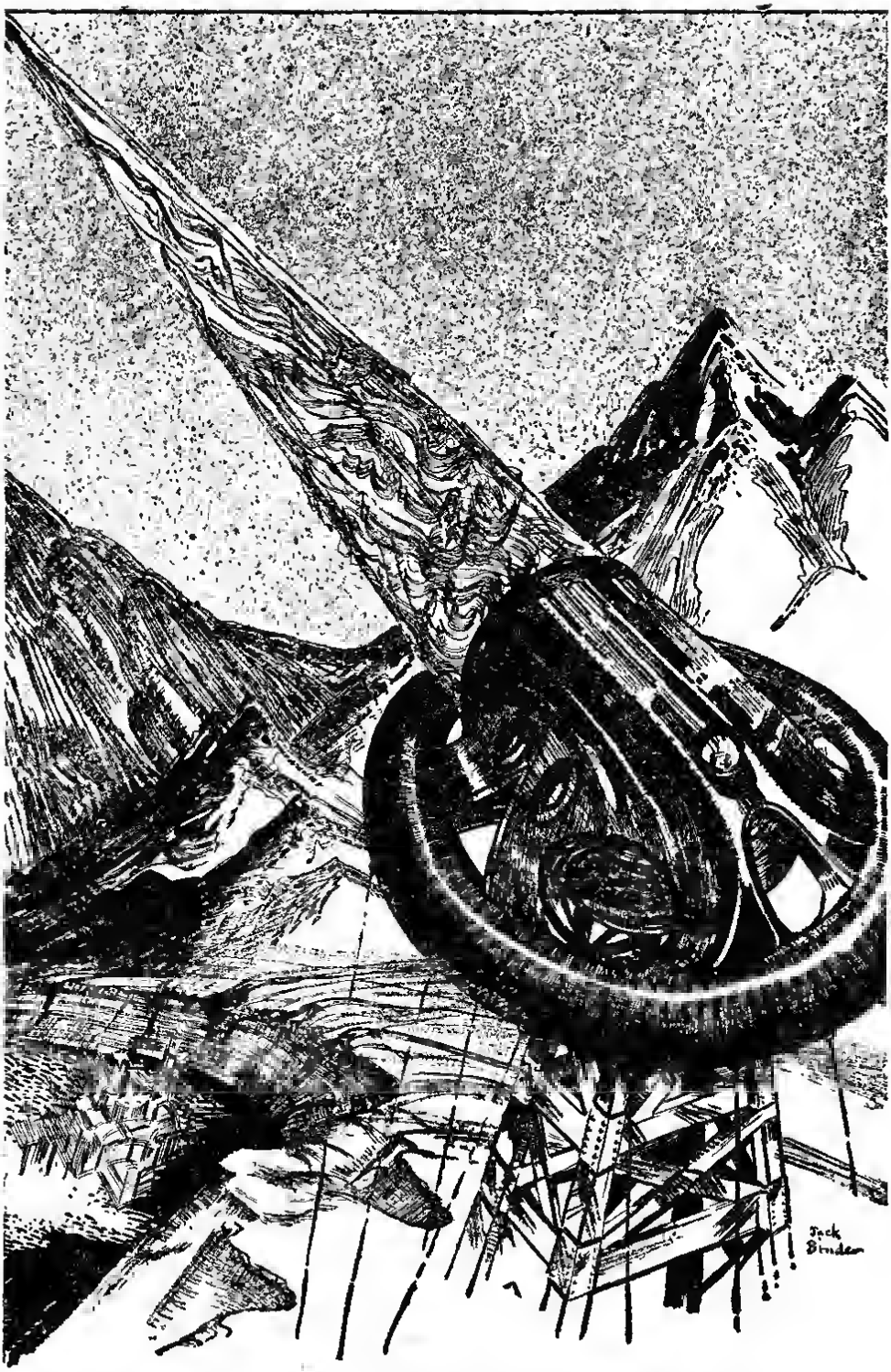
Beyond this main administrative hall was the view of a vast desert of sun-blistered sand, riven by huge gorges, soaked in the blistering heat of a slow-moving, unclouded Sun. Venus, revolving once in 720 hours, was a world without clouds, without protection from a Sun only 63,000,000 miles away. A blazing eye which had long since evaporated the seas and slowly plucked away the once heavy atmosphere.

Far away on the horizon a whirling dust storm rose black against the brazen blue of the sky, settled, rose again. Kil-Dio made an odd sound—a sigh of deep regret.

"It requires no words of mine to emphasize approaching doom," he resumed. "I have been in consultation with Ri-Dathan, our chief astronomer, and he is of the opinion that our only method of escape is to steal the seas and atmosphere of a neighboring world—preferably that of the world which is fourth from the Sun—Rinia, as we name it. There, there is plentiful atmosphere and water. By the theft of those seas we can transform this world of ours into a youthful, thriving planet once more."

"Can we not migrate to this fourth world?" questioned Bi-Tokar, self-appointed spokesman for the assembly.

"We could, but it might mean—in fact *would* mean—war. We would lose many of our numbers, and that we cannot afford. Further, I do not believe we could accustom ourselves to the fourth world's far lesser gravitation without adaptation beforehand, and since adaptation must begin with birth, that is obviously quite impossible for our particular generation. This fourth world is only forty-two hundred miles in diameter, whereas our world is nearly twice as large. Our gravitation is double. Only by adaptation could we tolerate half our present attractive pressure."



73,000,000 miles across the void the vast force-tube leapt——

"Then what of the third world?" Bi-Tokar persisted.

But again Kil-Dio shook his head. "No. It is a young world, raged by tempests, and in many parts still steaming with poisonous vapors. Similar in gravity, yes—but that is all. As yet, its atmosphere and seas are too fetid for us, at least by comparison with the perfect offerings of the fourth world."

There was a brief silence, then Bi-Tokar spoke again. "Has the excellent Ri-Dathan considered the possibility of our own moon? Could we not migrate to——"

"Again, no. Our moon is only three thousand miles in diameter, and airless. But the main point is that it is infested with inert life spores, deadly indeed to us. Were we to bring an atmosphere to our moon, and warmth, those life spores would flourish and might even finally destroy us with toxic emanations. And also, we would again be faced with less gravity. No, our moon is definitely discounted. There is no way other than to attack this fourth world."

Adamant in his decision Kil-Dio descended from the huge, stone platform by long slithering motions, passed through an adjoining doorway, and crept into the long passageway that led to his major laboratories and machine rooms.

KIL-DIO'S SPEECH had represented the consummation of plans the Venusians had not hurriedly made. They had known through generations that they lived on a world too close to the Sun for comfort, had known that one day the searing primary would absorb all the moisture they so needed for life. In itself, it had been a slow process, but, of course, far faster than on a less Sunward world.

At the first, Venus had had heavy clouds, but with the slow progression of ages they had gone. Little by little, the expanded gases of the upper atmosphere, open to the torrid rays every 720 hours, had leaked out into space. Rain had become less and less frequent and had now ceased entirely. The once soft, fertile land had dried up, until now it was split into arid plains and chasms under the eternally cloudless sky.

It was the same in every part of Venus. The whole planet was a scorched, dusty wilderness, its only life consisting of the five thousand who had grouped themselves together in their surface city at the base of a vast mountain range, its highest peaks soaring fifteen miles up into the cloudless, brazen skies.

Long days of saturating heat; long nights of bitter cold, for the thinning atmosphere held little of the scorching warmth of the daytime. During the dark hours, when their moon silently rode the starry skies, the Venusians sought the shelter of their underground honeycombs, deep under the mountain range, to emerge only when the Sun once more flamed in intolerable grandeur into the sky.

Heat they were accustomed to—it was their natural state—but lack of water and the presence of cold were their absolute enemies. The former they needed in copious quantities, both as free oxygen and hydrogen and the combined H_2O form. For ages their synthesizing machines had done much to meet their needs, but now the time had come for definite action. Further delay would bring about the extinction of the race.

Kil-Dio's emotions were not of the happiest as, in company with his chief scientists and Ri-Dathan, the astronomer, he studied the image of the fourth world in the flawlessly polished mirror of the X-ray telescope. In the merciless blue of the Venusian-day sky the fourth world was naturally invisible to the eye, but here in the observatory delicate fingers of light-gathering power reached through the rock that buried this underground place, and passed out into the

endless deeps of space to repattern on the mirror exactly what they saw.

This time it was a thriving, prosperous world of green, clouds floating serenely in its atmosphere, cities sprawled amidst its emerald landscapes, the dots of seagoing shipping scattered over its oceans. Rinia! Or, as it would come to be known in the dim future of a race struggling slowly up the third world's evolutionary scale, Mars.

"They are intelligent, these Ranians?" Kil-Dio questioned, pondering.

"To a certain extent," acceded the astronomer. "They have space travel by crude rocket propulsion, they understand radio to quite an advanced degree, and they seem well versed in all the ordinary sciences—but even so they are far behind us. In appearance they are rather queer, but then life on other worlds is very unlikely to take the same form as ours. The Ranians walk upright on two legs, possess round-shaped heads crowned with strange furry mats. Their eyes are set flat in their craniums and they have queer openings that are presumably for the purpose of food and speech. Revolting creatures indeed! And they are big—very big. I would definitely place them as eight feet tall."

"Lesser gravity demands greater size," Kil-Dio murmured. Then, "And their atmosphere?"

"Perfect for our purpose, Excellency. Oxygen and hydrogen in great quantities, together with nitrogen, argon and krypton. Their oceans are absolute combined oxygen and hydrogen with a heavy percentage of chloride of sodium."

Kil-Dio was silent for a while, then seemed to come to a decision. He spoke quietly, regretfully. "Our plans must be acted upon. In a few more hours it will be night and time for our rest period, but afterwards we will all set to work with the scheme we have laid—the erection of the absorption-vacuum on the mountain range and its linkage with the machines in the adjoining laboratory. There must be no delays. Is that understood?"

The gleaming heads of the astronomer and attendant scientists inclined in assent.

II.

WITH THE coming of the next day-period activity began. Silent, faultlessly efficient robots marched single file to a point 2,000 feet up the near-by mountain range, bearing metal-synthesizing machines, tools, and scientific engines of all descriptions. They were nearly all day on the ascent, a long irregular line of metal figures on firm, jointed legs, gleaming in the sunshine, only halting when they finally gained a broad, natural ledge extending for an area of three miles before the mountain range began the second, upward thrusting to vast, unscalable heights.

Kil-Dio and his immediate scientific colleagues reached the heights in a fast ascending levitator, operated by means of gravity-shields. They directed the operations of their robot servants efficiently, but they had only started when the intense cold of the night put a halt to work for another 720 hours.

Then, with sunlight again, the real work began. The huge ledge was disrupted in the center for an area of half a mile diameter, going down and down in the form of an enormous cylindrical shaft, sinking at last to a depth of a thousand feet, its sides lined with sheets of pressure-resisting alloy. Night came—day came.

The Venusians and their servants worked untiringly, watching the slow erection of a vast, latticed tower of metal, mainly comprised of four three-foot-thick girders held in position by crossed and lateral bars and struts. Twenty days later it was finished, rearing to a height of a thousand feet—huge enough, but seeming dwarfed by com-

parison with the vast range against which it stood. It commanded a view of the sun-soaked terrain below, stood over the Venusian city like a guardian presence.

At its top reposed a huge circle of polished copper, able to turn swiftly on massive gimbals, and within the center of the circle, suspended by electromagnets, was a curiously designed transmitter, fitted with numberless graded lenses. Both this instrument and the copper hoop were connected by stout cables dropping the length of the tower and thence passing through the supporting bed of now-hardened pressure-resisting metal in which the tower was embedded. From this point the cables continued their journey to a complicated switchboard deep under the city in the night quarters.

The most difficult part of the work was done—the rest was a matter of careful analysis and computation.

IN the course of another day Kil-Dio and his entire race forsook the upper ground levels of their city and sealed themselves below. If their plans matured according to expectations a sea would finally roll where the desert now stood, obliterating their city beneath its waves. But against this possibility they had taken the fullest safeguard.

A network of tunnels and shafts passed into the mountain range from their underground habitat and emerged at a point 6,000 feet up the range. These served as air-purifying vents and could also be traversed and ascended in the levitators. From such a vantage point up the mountain the Venusians hoped to be able to take stock of their remade world when the tumult was over.

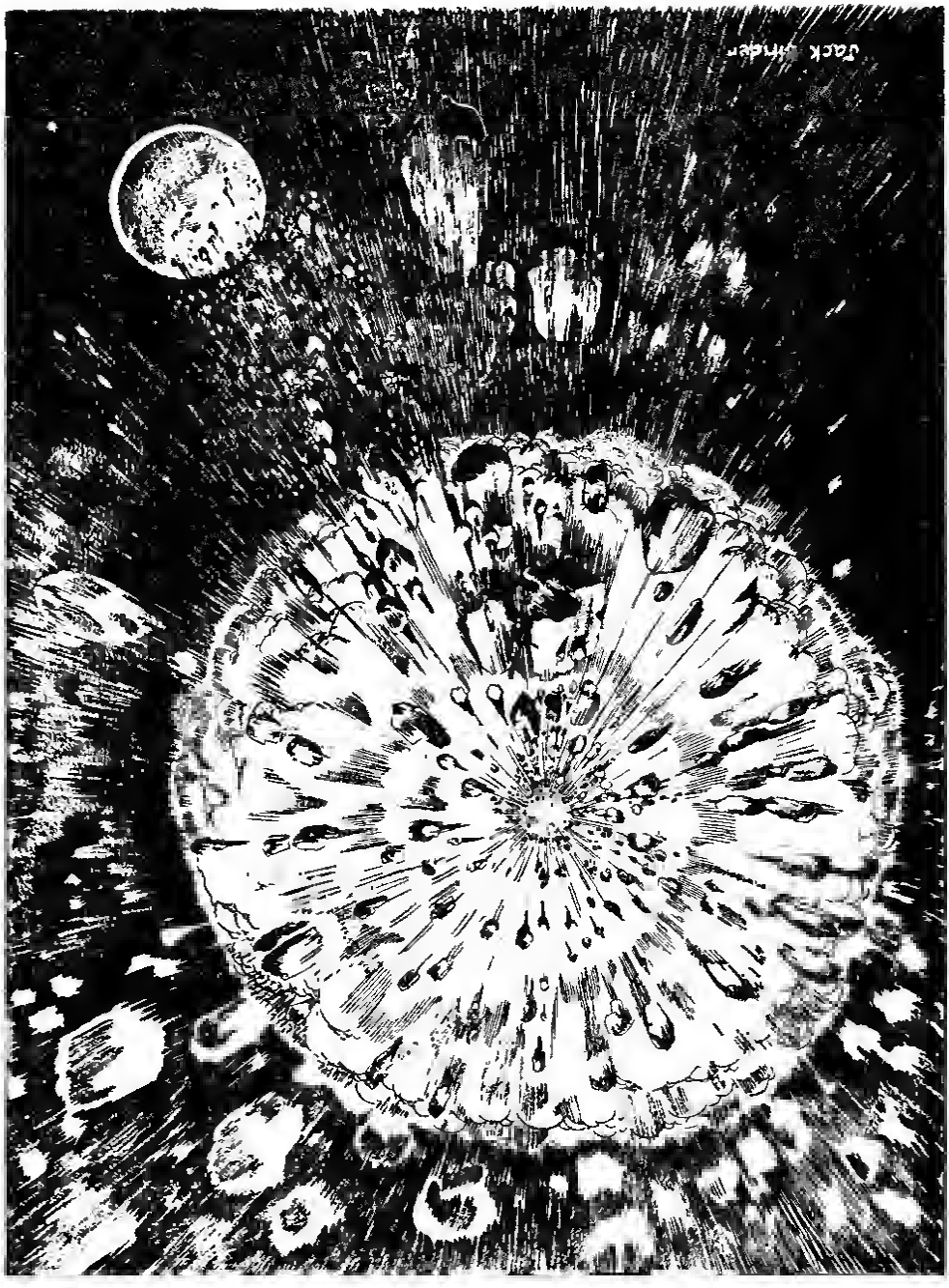
No possibility had been overlooked, nothing left to chance. The valves that closed the roof of their underground city had been tested and found capable of withstanding an almost inconceivable water pressure, a pressure which could only exist on the bottom of an ocean. Certainly it was impossible for them to be drowned.

Kil-Dio had thrust most of his misgivings aside when the time finally came to take the last steps. His first regret at stealing a prosperous world's lifeblood had vanished before the realization that in nature only the fittest can survive. If he and his race were so much cleverer than their neighbors—so be it!

Standing in the vast laboratory, he looked silently round with his stalked eyes upon the gathered, interested members of his race. Vast electrical engines of every shape and design stretched around him in a wilderness of gleaming metal. Generators, vacuum tubes, enormous anode and cathode balls roped together by slender but incredibly powerful filaments, great bridges and ladders of insulated metal perched between titanic electromagnets—the whole gamut of *n*th degree electricity was present, some of it comprehensible to all those who watched, but much of it an enigma reflecting the prodigious intellect of its conceivers.

At length Kil-Dio spoke: "Gravity, as we well know, is as much a force as cosmic rays, light or heat. It has definable limits and its power can be increased or decreased at will—that we know from our levitators, which lift easily against the pull of gravitation. Also, we know it from our space machines which shield gravity and hurl us away from any gravitational field. We know that, even as ordinary radio waves can be heterodyned, so can a correct force operate to 'heterodyne' gravitational fields and render the part in question entirely free of gravitation. This, then, is our plan:

"Across space, directly to Rinia, we shall project a heterodyning beam, which, when it strikes Rinia, will encompass some one thousand miles of surface area. This heterodyning beam will be in



Petlo's calculations were right in every detail—no ring formed, but the vicious spores rained down.

the exact center of what we might call a funnel of force. That is to say, this funnel will be a beam having walls of vibration solid enough to withstand the sudden uprushing vortex of water and air. Obviously, with part of Rinia degravitated and this force funnel immediately over that part, the air and oceans

will be sucked up our force tunnel by the normal process of following the line of least resistance. But for our force tunnel they would spew Sunward, hence the presence of the tunnel to hold them in one fixed path, until they deluge down on the surface of this world."

"And the people and cities?" questioned Bi-Tokar gravely. "Will not they, too, be absorbed toward the tube and rain down upon us?"

"No, because the binding molecular forces that hold solid things together will be destroyed by our forces, but degravitated water and air can only reassemble into their original nonsolid form."

Kil-Dio turned aside with Ri-Dathan and studied the elaborate computations built up by the clicking mathematical machines. In silence he checked the exact position of 73,000,000-mile-distant Rinia, together with the path the heterodyning beam and tube of force would have to take through space.

His stalked eyes turned and regarded the meters on the solar energy potential scale; they registered 86,000,000-volts potential energy. Almost in silence the energy-storing apparatus continued working under 30,000-volt pressure, catching on its endless series of brushes a constant flow of charges directly from the Sun itself.

Satisfied, Kil-Dio slid his body along the insulated floor, moved by degrees to the region of the immense switchboard, nerve center of the mammoth machinery frowning around him. Delicately his quivering body tentacle closed a master switch, to release an instant babble of din.

ENERGIES, terrific in their scope and power, leashed though they were, burst suddenly amidst the machines. The yellow-lighted laboratory became bathed in quivering, pale-violet flame, began to reek with ozone. Shivering purple threads lashed themselves like living things between the anode and cathode globes. With a crashing, crackling roar the energy blasted from them into the midst of swiftly rotating copper balls and whirling, humming governors. Tubes flared green; dynamos shrieked a deafening whine of song. In the distance, a group of gigantic turbines spun before the onrush of synthetic water, shot through with rippling filigrees of amethyst color. Bolt after bolt of energy slammed into the transforming chamber of the energy-projecting ma-machinery, hurled thence through the cables to the complicated apparatus atop the external tower.

Kil-Dio squatted motionless before the switchboard, stalked eyes jerking incessantly from meter to meter, gauge to gauge, avidly following slender threads of red that quivered to a danger mark and then dropped swiftly as he closed switches with methodical movements.

The laboratory began to quiver with the intense, exultant thunder of that energy. Stifling heat beat along its length, but the Venusians were accustomed to that. They were not watching Kil-Dio's intense efforts. Their attention was fixed alternately on two screens —the one giving a view of the tower outside by X-ray wave transmitters, and the other a view of Rinia, kept constantly in position by the clockwork motors.

The heterodyning wave working from the complex apparatus in the center of the copper hoop was invisible, only the jerking meter needles testified to its light-fast progress across the gulf of space. But within a few minutes there burst forth from that enormous copper circle a sudden dazzling lavender beam, stabbing into the star-dusted sky until it wast lost in utter remoteness. The sandy, arid plain below became bathed in the alien glare of electrical fire. Dust storms gathered and whirled, eddied into sudden violence by the tremendous disturbance in the atmosphere.

The Venusians watched breathlessly, steeling themselves against the glaring, flashing riot of self-inflicted thunder and lightning. Their gaze was now fixed on the Rinian spacevizor. Since the tube of energy was traveling across the void at the speed of light it would take some 6½ minutes to cover that gulf of nearly 73,000,000 miles.

The din remained constant; the energy-tube flared in unvarying pale-purple fire from the copper ring on the tower—— Seconds crept into minutes —three—four—five——

Six! A low sound, the equivalent of a sigh, passed from the Venusians as they saw that the gravity-heterodyning beam, slightly in advance of the force tunnel, had arrived. It struck that thriving, green planet clean in the center of its principal Venusward ocean.

THE RESULT was immediate—and cataclysmic! With gravity suddenly rendered of no account over a thousand mile area, all things within that area ceased to hold together. Ships caught in its midst flew apart, the very atoms of their constitution no longer obeying normal attractive laws. They mushroomed out, visible on the mirror as blurs on the ocean.

The sea itself writhed and tumbled as though suddenly stirred by titanic submarine forces. A vast tidal wave shot to the zenith—and at that identical second the tube of force struck squarely over the area, a pale, enormously distended haze of lavender enveloping three-quarters of the ocean.

Degravitated, helpless to hold onto their native world, both sea and air thundered in a thousand incredible furies and spuming cataracts toward the vacuum of the force-tube area. The tube drew a hole in the ocean with the mighty force of a super suction-pump, drove deep down to the bed of the ocean—but there the range limit of the heterodyner ceased. On the ocean bed the law of gravity was still normal.

The whole face of Rinia changed, became covered with a tempest of unimaginable force. The clouds thickened, whirled madly, obscuring the vision below from sight. Only that purple beam probing relentlessly through the murk told how successful the scientists of Venus had been.

Those in the laboratory turned their attention away from the murky enigma and instead searched their exterior vizor. They had not long to wait.

Abruptly, the clear flickerless intensity of that empurpled hoop atop the tower was blurred by the arrival of the first conglomerated mass of air and water from Rinia, literally thrust through the hoop like water from a hose nozzle. A raging, gushing tumult of uncounted quintillions of ice shards slammed into the mountain range and rebounded in a mighty avalanche, whirled thicker and ever thicker, black against the stars. In a few seconds the entire view of the beam was obliterated by tumbling vortices of desperately twirling atmosphere and water vapor.

The din of a thousand Niagaras and tempests reached to the ears of the buried scientists with a noise like distant thunder. The smashing of their external vizor by the impounded fury of waters and cyclone deprived them of viewing the consummation of their masterpiece. They could only guess——

There was nothing they could do but wait—through days, through weeks if need be, until Nature herself formed the balance and allowed them to take their first survey of a rejuvenated world.

III.

VIRANICUS PETLO, of Mars, was deep underground when the cataclysm came. It was no coincidence that found him there—his work as an electrical and mining engineer kept him deep under-

ground most of his life, in company with the scientists who represented his colleagues from the Mining and Radio Association.

Like the rest of his race, Petlo was massive in appearance, well over seven feet tall, broad-shouldered, yellow-eyed, with the flat face and broad nostrils of the true Martian. Otherwise, he was not very unlike an Earthling of the present day.

He was testing a seam of ore when he received the first warning of danger. The alarm clanged noisily down the long, cold-light illumined tunnel. Figures came flying helter-skelter toward him; a babble of voices smote his ears.

The deep rumbling and booming of external thunders growled above the shouting. Fissures gaped and leapt avidly up the tunnel sides. Lumps of rock clattered down from the roof.

Petlo gripped one of his comrades as he came gaspingly up. "What is it? What's happened?"

The man gulped for breath and slanted his yellow head toward the screaming radio at the far end of the tunnel. "Earthquake or something on the surface! Sort of cyclone, tidal wave and landslide. Can't quite understand it. Better stay down here until it stops. I think the shaft will hold."

Petlo studied it grimly. "In thirty minutes of this vibration it will come through," he said finally. "I'm heading for the surface."

"Don't be a fool, man!" the other cried hoarsely. "The conditions are far worse up there than they are here. I've just been through to the surface by radiophone and things are so bad I——"

"I've got a wife and son to think about!" Petlo retorted. "You can do what you like!"

He wasted no further time on words. On swift feet he raced down the tunnel's length to the accompaniment of the growling and creaking of tortured, slowly cracking walls. A massive piece of ceiling dislodged itself not a foot behind his flying form. With a set face he raced along the last stretch of the tunnel and gained the elevator shaft.

Clearly to his ears down the 400-foot bore came the roaring and whining of a thousand furies, the scream of a super wind, the hammering madness of a raging atmosphere. A momentary frown crossed his dogged face. The thing was utterly abnormal. Storms of such extreme severity were practically unknown on this world of Jondol.

A deeper roaring suddenly replaced that of the wind. It rose louder and louder, developed into a scream that mingled oddly with the screech of voices—— Faster—faster! Only just in time Petlo flung himself away as the shaft cage came slamming down in a cloud of dust and struggling, dying figures.

For perhaps ten seconds he stood appalled, then realizing he could do nothing, he vaulted onto the wreckage, seized the framework of the shaft wall and began to ease his body upward inch by inch.

It was a ghastly, nightmare ascent. The shaft quivered incessantly, more than once threatened to fling him down the ever-widening distance to the floor below. His fingers were bleeding, his body drenched in sweat, but little by little, finger and toe, he went upward, ever upward, only pausing once at the sound of vast concussions from the depths. He realized he had been right; the lower shaftings had caved in.

HE fought up the last hundred feet with brittle muscles and, more dead than alive, crawled over the edge of the shaft and lay prone, not daring to lift his head over the projecting rim into the screaming, insane tumult around him.

Dazed, incredulous, he watched a sky that was thick with boiling, swirling clouds, tearing toward the sea not five

miles away. Buildings, trees, whole landscapes were shifting and whirling toward that unseen spot. It seemed to be centered somewhere over the ocean itself. More he could not discern. He felt his skin prickling with the sensation of electrical discharges; he could feel that his hair was crimped.

The only thought in his mind now was for his young wife, Nidia, and their son. What had happened to them? What could have—— He began to crawl on hands and knees, lashed by a tempest of inconceivable power, drenched in battering rains, his way lighted by flashing bolts of insane thunder and lightning.

He crawled two miles through the thick of a seething hell—another mile and he'd be at the spot occupied by his isolated home on the outskirts of the city of Kilanton. As he struggled onward he caught glimpses of the city's lofty spires and edifices tumbling and falling wildly before the onslaught. Other parts were utterly washed away in moving landslides as suddenly deviated rivers frothed and foamed seaward.

Still Viranicus Petlo did not understand. His mind was a whirling mass of tortured emotions. He crawled the last mile on knees that were cut and bleeding, clawed with fingers that had long since lost their feeling, listened like a dulled, hunted animal to the screams and shouts of the others of his fellow men and women as they were caught up in the hurricane and hurled helpless through the screaming air.

Stupidly, weighted down with the rain, Petlo pawed through the crumbled mass that had been his home, until it suddenly came to him what he was doing, where he was. With a sudden mad energy he began to hurl stones and boulders from before him, diving deep down into the debris, searching for the crumpled, maimed bodies that had been his beloved wife and son.

For thirty minutes he searched, defying the snatching fingers of the cyclone and the searing thunderbolts. Then suddenly he stopped his activities when his powerful hands closed round a ring of metal. It pierced his confusion that it led to the cellar of his home. Could it be possible that Nidia—— Madly he tore on the ring, lifted the metal square upward and stared beneath with yellow eyes that were insanely glad. Dimly visible were the sprawled figures of a slim woman and a boy, unconscious.

With shaking legs Petlo went down the steps into the cellar, pulled the lid down after him and bolted it securely. Slowly, gently, he felt around in the dark and lifted the limp bodies in his arms, caressed them, thanked the Providence that had led them to hide down here.

In grim-faced silence he listened to the screaming insanity above—the rumbling and growling of a world in sudden death agonies. He listened and listened, through hours that were numberless——

EIGHT DAYS and nights of sheer, unparalleled horror came and went before the ghastly onslaught upon Mars showed signs of ceasing. Then, at long last, the wrenching and straining of a flogged world began to ease up—the titanic winds abated; the quaking and quivering of the quakes subsided into an aching, placid calm.

Half conscious, tortured by hunger and thirst, Viranicus Petlo began to move. His wife and son who had been conscious for part of the time had now relapsed again. The air in the cellar was stifling; the ventilators must have become partly blocked.

Petlo crawled to the trapdoor and pushed on it. He experienced hut little difficulty in raising it—not many of the boulders he had moved from it in the first place had replaced themselves.

It was day, and the light stung his eyes for a moment. A day such as he

had thought could never happen in his lifetime. Cold, biting wind, incredibly rarefied, cut around him. The sky was cloudless, of an intensely dark blue shade that spoke at once of a thinned atmosphere. The Sun hung at the zenith.

Shivering in his thin clothes, Petlo gazed blankly on a scene of profoundest desolation from which all traces of the things he had known and loved had apparently been blasted. Kilanton City was a shambles of smashed and tumbled stone. Hundreds of crushed bodies lay in every imaginable posture. Not a thing stirred, save that in the far distance a ragged flag had freakishly escaped disaster and stood waving drearily now in the icy wind.

Petlo stared out to where the sea should have been, but there was no sea —only a vast, incredible, yawning desert, puddled here and there where slight condensation had occurred. In the midst of it, rotted, unexpected, lay the hulks of ships that had sunk in a forgotten time.

"Gone!" Petlo whispered at last. "All gone! Our seas—our peoples—our progress. Everything that goes to make a world. But *why?*" He dumbly sought the heavens—then a twinge in his stomach and the dryness of his throat reminded him that food and drink were needed, and quickly.

Getting to his feet he staggered toward the major bulk of the city. Here and there buildings were standing—skeletal, parts of the interiors left untouched. There must be food somewhere—tabloid food perhaps. And water! There must be water somewhere. There had to be——

VIRANICUS PETLO found food and water—quite a fair supply of it—in one portion of the city. Once he had revived Nidia and the boy, Ladima, they all moved to that portion and made their home in the basement of what had formerly been an enormous, multiple store. In his subsequent ramblings Petlo also found parts of the Mining and Radio Association Building still intact.

There were tools, precious oxygen and hydrogen cylinders still undamaged, machines, electrical equipment, and a hundred and one useful devices that came readily to his fingers. He made the store basement airtight against the frigid night cold and fixed up a crude, but satisfactory, system of waste-air disposal, mingled the oxygen with the hydrogen gases to provide water when necessary.

That was at first, but at the end of five weeks others came, bringing their children—others from every walk of life—engineers, scientists, laborers, miners, each of them bringing their own particular discoveries resurrected from the ruins. Little by little a basement city grew up in the ruins of shattered Kilanton, ruled over unquestioned by Petlo himself.

But Petlo had changed. His whole nature had undergone a metamorphosis. The first realizations of the hideous wrong that had been done his beloved world were burning in his brain.

"It was deliberate! Deliberate!"

He made that passionate declaration on an evening when Halvan, a chemist, his closest new-found friend, called upon him. Halvan was a quiet sort of man, less fiery than Petlo, and devoted to the wife and young daughter who now sat beside him in the glow of the roughly erected cold-light bulbs.

"Somebody or something stole our water and atmosphere!" Petlo flamed, pacing angrily up and down.

"In that you are correct," Halvan agreed thoughtfully. "During my recent wanderings I explored the Eastern Observatory. Part of the big reflector is still intact, so I made use of it—studied the heavens for a possible explanation of the recent catastrophe. And I found it! Jalva, the second planet from

the Sun, now has an atmosphere of considerable density where formerly there was none! Clouds completely obscure its surface. Formerly, it was reckoned as an almost dead world."

"Jalva!" Petlo cried, halting in his stride. "You mean then that——"

"I mean that it is probable that by a process of superscience the inhabitants of Jalva, whom we thought nonexistent, robbed us in order to rejuvenate their own world. Our science is not as good as theirs, and therefore——" Halvan shrugged moodily.

"We still have rocket ships which can be repaired," Petlo said fiercely. "Can we not band ourselves together and raid these thieves? Destroy them?"

"Our little band against an entire race of superscientists?" Halvan shook his graying head doubtfully. "I don't think so, Petlo. There is nothing we can do but repair our shattered fortunes as best we can. At the best we can only wait for the end."

"And a pretty depressing idea that is!" Petlo retorted. "The point is for us to revenge, not to take this lying down——"

"But Halvan is right, Viran," interrupted Nidia quietly. "Just what *can* we do—we few on a world rapidly dying as the last air thins out? Our children will perhaps live their lives through in this underground place, and then—— And then the world will be dead."

Petlo did not reply. Scowling with thought, he seated himself and began to ponder, thinking, planning, his whole vigorous being concentrated on one end —vengeance!

IV.

THE COMPLETE metamorphosis of Viranicus Petlo was a slow but resolute thing. From the first he took command, was the leader of the remaining people in their constant expeditions amidst the shattered ruins of Kilanton. Little by little, through tireless searching, they began to unearth more and more scientific devices, or else the necessary materials for making them. Petlo, driven by one profound obsession for avenging his world, worked mysteriously toward an end.

At the end of a year the survivors had accomplished miracles. Part of the city had been rebuilt underground—was a passably comfortable region, quiet and law abiding. There were all the necessities of life now; resurrected synthesizing machines had seen to that. Amongst other things, Petlo had had the Observatory reflector remounted in his own laboratory, its nose poking inquisitively toward a dome of pure, undistorting, newly blown glass. Save for a slight furriness of image occasioned by the glass, the instrument worked perfectly.

For endless hours Petlo studied the second world during the cold nights, brooded over its atmosphere and now-consequent high albedo. With malicious care he studied its whirling little moon, brilliantly lighted by both sunshine and primary light. He made copious notes of what he saw in the valleys of that moon, smiled grimly, but held his counsel.

His main object thereafter was the reconditioning of one of the two surviving rocket ships. It took five weeks to fit it out in spaceworthy style, and once it was done he set off alone into space, headed directly for that brilliantly gleaming world and its moon so close to the Sun. He would do nothing rash—that was all he would promise to the anxious Nidia and his friends.

Sixteen long weeks afterward he returned from his sojourn, grim-faced, more resolute than ever, but still divulging little of his plans. Instead, he set to work—after a series of private experiments—upon the construction of a highly sensitive remote-control radio transmitter. This was his special field,

but he had to surmount constant obstacles due to lack of material and the necessity of having to make some of it firsthand. But in the end his ingenuity, untiring energy, and the assistance of his friends succeeded in creating an apparatus of remarkably delicate power, able to extend its influence across the void from his own world to the second one.

When Halvan or Nidia questioned him his only response was a cold, bitter smile. Instead of giving any information he turned next to the reconditioning of the remaining rocket ship, fitted it with automatic blast controls, carefully timed, and switchboard mechanism attuned by a complicated radio receiver to his own short-wave transmitter.

THEN he spent three weeks loading the ship very carefully with loose *ixion* powder, perhaps the most powerful explosive known to the planet and used in the boring of mines and rocket-ship detonators. He had found the stuff still unharmed in the depths of its steel armory deep under the half-shattered Association Building.

"But what's it all for?" demanded Halvan one night, when at last the ship had been loaded and the two families reclined comfortably within their basement. "What are you trying to do? Hurl that ship of *ixion* at Jalva? If so, it won't avail you much. The dense atmosphere will explode it long before it reaches its surface, and at best you'll only kill a few."

Petlo smiled grimly. "Nothing so childish as that, Halvan," he answered steadily. "When I went on that space trip my object was to discover the reason for brown smears visible through the telescope in the valleys of Jalva's moon. I found the smears were spores, and when I tested them here in warmth and oxygen and hydrogen they sprouted into plants—emitted a toxic, carbon dioxide, which is of course definitely fatal to an oxygen breather. The Jalvians are oxygen breathers. We know that because they took our atmosphere!"

"Well?" questioned Halvan quietly.

Petlo went on talking with fevered earnestness. "I plan to fire that second rocket ship to Jalva's moon, guide it there by remote-control radio. Once it strikes, it will explode with devastating violence. There will be no atmospheric resistance whatever—the explosion of all that *ixion* in one mighty burst will shatter that three-thousand-mile moon into absolute meteoric dust. The outcome is obvious. The dust and the spores will sift down in a dense carpet to Jalva's surface. The spores will sprout! Time and time again the Jalvians may mow them down, try and destroy them—but one cannot forever defeat a thing of that nature any more than before the cataclysm we could utterly have destroyed all green stuff. These plants multiply with incredible speed and will thrive in that warmth and moisture. Finally, they will drive the Jalvians away from their planet by their very toxic emanations."

"In generations to come, maybe," Halvan acceded, thinking.

"I am dealing with generations to come," Petlo answered strangely, a far-away look in his yellow eyes. "I am dealing with a time that lies in the far future—so far away we cannot picture it, when by the natural law of inheritance and a reasonable supply of luck I expect to attain my revenge. When my son, Ladima, and your daughter, Esonia, reach maturity they must marry. It is essential! In the last stages of my plan, another world will play its part—the third world, the young one we call Kilbani."

Halvan said nothing. He listened silently as Petlo went on.

"My next scheme is the hardest and mightiest of all. I plan to drive an irrigation system right across the face of our world—yes, from pole to pole—a

network from the icecaps. For water, but also for another, profounder reason. For revenge! Later, you will see my point. First the rocket ship must be fired. Ages may elapse before the spores from that moon become sufficiently annoying to finally impregnate the Jalvian atmosphere with their toxics and render it too poisonous for the Jalvians to remain. I intend to dispatch the rocket to-night."

"But how does this canal system fit in with the spore idea?" Halvan questioned. "What has it to do with it?"

"Everything," Petlo answered, and smiled mysteriously.

THE ROCKET ship was fired from its 45° cradle two hours later, from a point situated in the lone area of the dead sea bottom. Petlo's calculations, worked out to the last detail, had assured him that the automatic controls would work perfectly with his radio. The rocket tubes only needed the initial automatic blast to drive the machine out beyond the gravitative field and thinned atmosphere. In free space it would move by perpetual motion, guided by the radio waves.

Petlo set the time switch of the rocket-firing chambers, locked the airlock from the outside, then, wrapped to the ears in furs, he returned with Halvan to the position of their underground home and laboratory. By the time they had reached it the blasting roar of the rockets smote on their ears. The ship hurtled skyward in a long arc of flaming, vivid light, climbing into a remote, disappearing point that was swallowed up in the clear, motionless glitter of the stars.

Without speaking the two descended into the laboratory. Halvan took up his position before the telescope mirror. Petlo sat before his switchboard, hands tightly gripping the polished knobs that controlled, in conjunction with mathematical predictions, every movement of that hurtling, unseen flyer in the deeps of space.

Both of them sat hour after hour, the womenfolk bringing them food and hot drink at intervals. They dared not sleep, hardly dared to move, until their task was accomplished. They sat thus for nearly four days and nights, checking each other's figures, charting and recharting the route the rocket must be taking. Halvan held the Venusian moon in the field of the great reflector by night, occasionally watching the flicking second hand of the chronometer.

Until at last, in a voice that ached with weariness, Halvan began to count, "Twenty-five—twenty-six——!" He stopped, smitten with awe. He was aware of Petlo and the others breathing hard over his shoulder.

Suddenly, amazingly, the calmly floating satellite of Venus spewed and belched outward in a trillion hurtling shards, broke up and splintered and smashed into boulders, stones, and vast swirling hazes of dust. The atmosphere of the mother planet writhed and boiled under the sudden alteration in gravitative fields. Somewhere under those clouds, oceans must have spilled over, convulsed into tidal waves, before they settled down to almost tideless seas.

The whole thing seemed to be over in minutes—but in those minutes a moon had died and settled into an enormous carpet of hazy fragments settling slowly toward the dense clouds. Petlo had been right in his judgment: the terrific explosion and inward thrust, together with the pull of Venus, had prevented the stuff forming into rings and, instead, forced it downward far enough to prevent the slightest suggestion of orbital formation.

Petlo drew a deep breath of relief, slumped wearily into a chair. In a few minutes both he and Halvan were sleeping heavily.

FOR SEVERAL weeks afterward Petlo and his people made no moves. They half expected a space ship to arrive from the second world to retaliate for the thing they had done. Finally they began to realize that the Jalvians must have interpreted the death of their moon to some cosmic catastrophe and not to a deliberately planned act by minds on a world they fully believed now quite dead. Besides, they probably had their hands full in dealing with the disastrous effects of tidal waves and the sudden growth of toxic plant spores.

So, feeling secure again, Petlo set to work on his mighty canal scheme. The simplest and most direct method was to use high-powered blast-guns operated from the few remaining fast tractors. This was done, every one of the men survivors being pushed into service, whilst the womenfolk attended to their domestic needs.

Even so, progress was slow. To design some thirty networking canals across a globe 4,000 miles in diameter demanded perpetual toil and work—by weeks, by months, by years. But Petlo still went doggedly on, ruthlessly determined to bring his strange plans to fruition.

At the end of a year ferric oxide was making obvious inroads on the planet. The old metal girders and skeletal walls of buildings were brightly red; the sea bottoms and vast devastated deserts crawled with rust. The air, too, was becoming dehydrated—the upper levels of hydrogen were leaking away into space, held only by Mars' slight gravity. The essential mixture for life was vanishing. At the most, the planet had only another century of breathable atmosphere left.

Petlo worked with renewed vigor, driving his canals across the plains, linking them up with central oases around which there grew a new type of plant, adapted to an air that was almost wholly thin oxygen. Ceaselessly, endlessly, red sand flew skyward before the battering blast-guns. An army of determined avengers gouged their planet from end to end, and only Petlo knew the purpose toward which he worked.

Two years—three years—five years, before the canal system was complete. Water flowed from pole to pole, to some extent irrigated the desert, but with the dehydrating air, life was still impossible on the surface. Petlo, however, seemed quite satisfied with his work, took a special care to initiate his son and Halvan's daughter—now eighteen and seventeen respectively—into every detail of his plans, impressed upon their young minds the paramount necessity for vengeance——

THEN, after two months' rest, Petlo started his last and ultimate feat—one which demanded all the scientific instruments of which the planet was capable.

He set to work on the construction of an enormous turbine, shafted to a dynamo able to develop immense power. This machine in itself, executed in the Martian foundries manned by laborers, together with the attendant careful planning, took another year—and afterward more time was swallowed up in the making of two vast obelisks of pure copper coated with a rust-resisting and highly conductive alloy. Both of them were 300 feet long and 50 feet wide at their bases, their tips tapering to a point. Once these were finished, heavily insulated wires wound on massive drums were manufactured, together with numberless sheets of metal tested to withstand a pressure of 1,000 pounds to the square inch.

Most of this apparatus was then transferred to the south pole, accompanied by dredging and construction machines for the purpose of drilling a shaft beneath the icecap to a depth of 500 feet. The top glacier was removed for a

square mile and the water constantly pumped away whilst the supporting sheets of metal were slid into position and firmly bolted and welded.

Lower the shaft sank, and lower still, until at the base it was made to widen out into a buried power chamber, likewise supported from the water and ice pressure by the prearranged metal sheets.

Two more years passed swiftly over in the construction of the power chamber. One of the massive copper obelisks was lowered to the exact center of the chamber and sunk into a pit fifty feet deep, filled in with insulated material that cooled to the hardness of age-old granite.

Then tbe turbine and dynamo were lowered and assembled. The latter was wired up to the copper electrode, and the former so devised that it was directly under a subsidiary shaft in contact with the flood waters below the ice-cap—the shaft being so arranged that after the waters had supplied their rush to the turbine they would be turned off into the exterior again through sluices without any danger of flooding the cbamber.

The vent hole of the turbine water shaft was in effect a huge metal cap, held in place by a massive bolt linked by a complicated contrivance of machinery to yet another of Petlo's short-wave, remote radio-control receivers. Once that remote-control apparatus was actuated, the shaft vent would dislodge itself and start the machinery, transmitting rising voltage of electricity in the dynamo and thence transferring the power to the copper electrode in the water outside.

The metal cap of the turbine shaft would remain open for sixty minutes, then an automatic spring actuated by a weight, would suddenly block the sluices and allow the chamber to flood. The whole idea was indeed a masterpiece of automatic engineering, capable of control from any distance——

And at the opposite Martian pole, during the interval, the other copper obelisk had been sunk in like fashion, but without a power house around it. It was, in truth, the negative pole of this astounding planet-sized battery.

Petlo's work was done. By the time the various equipments had been gathered together for the return journey, the icecaps had frozen over the copper electrodes and hidden them from sight. Thus buried, unexposed to the activity of oxygen in the open air, and composed of highly resistant metals, they could by very reason of their toughness survive for uncounted generations, until the day when automatic control would release that flawless vent machinery and set the vast turbine and dynamo in action. To the coming of such a day, Petlo had directed all his energies, and the energies of his people.

"THERE IS little left for us to do," was Petlo's announcement to his colleagues, when they had returned to buried Kilanton. "The remainder is left to chance, to natural laws, which will work out their destiny with the passage of time. In the far future, as I see it, the Jalvians will seek another world—driven from their own by the attack of the toxic plants. They could go to the third world, but I don't think they will, because it would mean involving themselves in battle with a race grown to scientific maturity, who would sadly deplete their numbers. No, I believe they will come here and try to repeat the heinous offence of stealiog water and atmosphere from the third world. They will start to adapt their people for migration to this planet, will probably arrange that each succeeding generation can live in less gravitative strain. It can be done by a process of slow training. Upon their coming here depends

the whole scheme upon which I have worked——"

"And now?" questioned Halvan.

Petlo looked across at the young man and woman whom he had seen grow from children—his own son, erect and tall, and the graceful dark-headed Esonia, herself a majestic figure seven feet high. They returned his look in silence as they sat close beside each other.

"The fate of a world probably hangs in your hands," Petlo said at last, slowly. "You know what I have done, have followed my every move. It is impressed in your minds to the exclusion of all else, together with the absolute need for vengeance. A year ago you were married according to our law; your child, or children, when born, will likewise possess your inherited strains and much of your knowledge. On that I have built: That our race can inherit knowledge from generation to generation. Your children's children will have it again, and so on through the generations until, when the time comes, a true native of this planet will appear and will know what is expected of him or her. Deep down in the brain of this unborn will be the memory of an object to be accomplished, a purpose to be achieved—— You will go to the third world—to-night!"

Ladima started up. "But, father, it's a poisonous world, full of strange gases, landslides, floods—— We may die."

"You will not die," Petlo returned, with calm decision. "Parts of that world are poisonous, but not all of it. Telescopic observation reveals many rifts in the clouds to the north, even signs of men not unlike ourselves, but smaller. And there are beasts—monstrous beasts which will fall swiftly before your modern weapons. You will go, live in your rocket ship if need be, teach your as yet unborn child all the things I have taught you, and he in turn must teach his child. And so it shall go on, until the final hour——"

"And you?" the girl questioned quickly.

Petlo smiled faintly and shrugged. "My work is done, my dear. The future belongs to you and Ladima."

And at sunset, when the desert was like a lake of molten fire, the lone rocket ship bearing husband and wife swept swiftly toward the stars, turned in a huge curve, and headed for the distant orb of the third world.

The entire survivors of Kilanton watched it go and on the stern face of Viranicus Petlo there lurked the ghost of a smile——

V.

BUT PETLO had been wrong in his assumption that his son and the young wife would survive the rigors of the third world. They landed safely enough, even ventured outside into the steamy, sweltering forest in which their vessel landed—but in ten minutes they were separated, attacked by a horde of savage men and women against whom they stood no chance. They tried to run, but the gravity held them down in its crushing load. They saw each other for the last time.

Months afterward, in the wild, primitive reaches of the forest, Esonia's child was born—but in exchange for his life, the woman's flickered out. Uncouth, savage eyes looked down upon the little mite that had come into their midst. Roughly, they began to care for it.

A thousand miles across the forest, forced to be a giant tribesman from the sheer necessity of living, Ladima Petlo forgot all the refinements of Martian civilization, sank swiftly into the strain of the savages with whom he hunted and slew—a mighty warrior indeed. One of the women he chose as his mate and it somewhat eased the dull ache in his heart for Esonia. Only one thing he

never forgot—vengeance! And he died, thinking of vengeance whilst the daughter-child his wife had borne him grew slowly to savage womanhood.

The link so perfectly forged by Viranieus Petlo was broken. He, too, had died on Mars with the belief that all was well. On Venus, two thousand sluglike beings fought steadily with the encroachment of lofty, vicious plants that steeped the dense atmosphere in a gradual preponderance of carbon dioxide. Kil-Dio was thinking of preparing a migration for his descendants, just as Petlo had foreseen he would.

Kil-Dio saw to it that each newborn child was raised in a vast nursery, with a gravitative force fixed to that of the fourth world. Some day, he realized, these successors would have to migrate to that planet. Not the third. That might mean war. But its atmosphere and seas by that time would be well worth having. He had succeeded once; his descendants could do likewise. Anxiously, Kil-Dio wondered how many generations would pass before the descendants were adaptable enough to live a natural existence——

And on Earth, a boy who was a true Martian grew slowly to manhood, all unaware that somewhere in the savage tribes there roamed his half sister, actually a half-breed, yet with the heritage of Mars as strongly developed in her mind as it was in his. They never met, these two.

When the time came, they mated Earthlings, became parents, but of necessity their children were removed halfbreeds, dimly aware of some strange heritage, the government of unknown mental urges, of vengeance, of a plan to be fulfilled——

Matehood—offspring—— Down through the centuries, and either by chance or inscrutable design, each child was, all unknown to its parents, a halfbreed.

Age upon age. Generation upon generation. The Earth changed and Man changed. But down through the ages the memory of a great purpose still hovered. Down the corridor of Time there echoed the remembrance of a plan to be fulfilled. . . .

JAMES LANGTON was born in 1996, of perfectly normal parents who had never excelled themselves in any particular way. His father was an engineer, and his mother, before her marriage, an electric type operator. Both of them were killed in a stratoplane smash when James reached the age of twelve.

But he did not go to a recognized institution. Instead, his adaptability with radio, astronomy, biology and kindred sciences was so developed that he obtained a highly remunerative position as the world's youngest technical adviser on all matters scientific.

He was a phenomenon, a genius, and knew it—but at twelve years of age he was not at all sure how he'd achieved that condition. So with characteristic thoroughness he set himself to find out the meaning for his knowledge, and why he was haunted by the ever growing conviction that he had a purpose to fulfill, some task to perform.

While he studied, he grew—with startling speed. At eighteen, he was seven feet tall, a massive blond-headed figure of a man, genial, thoughtful, only just on the fringes of discovery. The solution of the secret of his birth and strange abilities still eluded him.

To better pursue his astronomical studies—or so he believed—he gained an honorary position at the great Central California Observatory where a new 400-inch telescope had been erected and with it, brooding and silent, he searched the void night after night, studying moonless Venus and dehydrated Mars, trying to bring into his

mind the reason for a purpose—something for which he waited.

He prospered with the years. At thirty he had made enough money to retire and study things out. Through ten more years, little by little, he pieced together his strange memories, the memories of a world lashed by tempests and flood, of a tube of force and boiling oceans, of gouging canals, of buried machinery—— Hazy, indefinite things at first, but gradually they grew in clarity under the perpetual concentration of his extraordinary mind.

Section by section he began to understand his beritage, realized by careful analysis the strange state from which he had been born.

Either nature, unwilling to let a plan go to waste, had stepped in and played a hand, or else the unseen Deity that rules all things had seen fit to produce James Langton. Whatever it was, Langton traced his memory and heritage through the soberly logical fields of biology.

THROUGH generations the Martian recessive unit had lain dormant. And the genes, hypothetical submicroscopic bodies located in the chromosomes, are the unit factors of heredity. A change in the genes leads to the inheritance of new characteristics, better known as mutations.

In such a manner as two perfectly normal parents might give birth to an albino child, so, evidently, had Langton's own parents both possessed, by chance, the recessive Martian unit—far-flung throwback to the days of Ladima and Esonia. The final combination had at last brought into being what the long-dead Viranicus Petlo had hoped for—a true Martian. Now Langton understood: it was so clear. His racial memory, his desire for a world apart from Earth. His incessant studying of the void—he had a purpose!

VI.

ONE NIGHT he startled the chief astronomer at the Central California Observatory with a dry comment.

"Did it ever occur to you, my friend, that there might be a lot of Martian blood on Earth? That it might be the reason for a great deal of vindictiveness, revenge—even war? Perhaps Mars is called the God of War for a reason not entirely mythological."

Ward Dent, the astronomer, was not impressed. He was a businesslike, baldheaded individual, entirely concerned with facts and figures.

"How do you figure that out, anyhow?" he asked bluntly.

Langton shrugged his vast shoulders and smiled mysteriously. "Just a theory. If we suppose that somewhere in the past the Martians sent some of their people to Earth, is it not possible that their children might have their parents' ambitions in an unresolved form? If those ambitions were hate and vengeance, they might veer off into such channels as pettiness and vindictiveness, for no apparent reason. Normally, you know, a living creature isn't vicious or vindictive because it wants to be. It is an evil force matured through generations and nobody knows how it started. Animals, patterning much of their ways from the stronger minds of humans, are affected in the same way."

"May be something in it," Dent admitted, then he pursued the topic no further. He felt, as did many other people, that because the gigantic Langton was a genius, he might also be mad.

Langton sat for a while staring into the telescopic mirror, then he asked quietly, "Have you ever tried to conjecture if there is life on Venus?"

Dent looked up irritably from his notes. "Of course—but it's quite unlikely. There's no oxygen or water vapor for one thing. There might, though,

be some sort of life we don't understand."

"Suppose that the atmosphere of Venus is so dense that we can't penetrate beyond a few layers and the oxygen and water vapor are at the lower levels?"

"Possible," the astronomer shrugged. "Damned hot planet, though! Turns once in 720 hours. We used to think it turned one face to the Sun until we found that a thermopile directed at the supposed night side registered an appreciable amount of heat. That obviously couldn't be the case with a planet turning one face perpetually to the Sun. Pity of it is there's no moon. It would help a lot. Every other planet has one, save Mercury, of course. His went in the Sun long ago."

Langton slowly nodded his yellow head. "Venus probably had a moon once, but the Martians destroyed it," he murmured dreamily, and with that he turned back to the mirror, unaware of Dent's startled expression——

Then suddenly Langton stiffened and became earnest in his attention. For a moment the immense polished surface revealed something on the edge of Venus that was not entirely normal—a faintly gleaming speck that distinctly caught the strong flash of sunlight for an instant, and then was gone.

Langton sighed deeply. He knew his years of vigilant watching were finished. Gravely he bade the astronomer good night and went majestically out——

A WEEK later startling news burst over the world. It was disseminated from every quarter by the news broadcasters. Stratoplanes bulleted to all compass points with newspapers hot from the presses; international television hookups radiated stills from the California Observatory showing the amazing proof of the fact that something was visible near the Ismenius Lacus Oasis, on Mars—something bright and glittering that held out a prospect of active life, or else in the nature of a signal.

Earthlings were interested, but only a few were really eager—mainly those who made science their hobby. The only man who could have explained it all, James Langton, was nowhere to be found. His home was temporarily closed and he had left no forwarding address. Some said he was alone in an isolated laboratory somewhere in the upper Adirondacks.

In truth he was working on the final details of a remote-control radio instrument that was surpassingly clever in its efficiency, using for power the energy of a near by waterfall. He had started it on an impulse two years before. Now he knew he had to finish it. The memory of past ages burning vivid in his mind aided him in knowing something nobody else comprehended——

The adapted Venusians, last of their race, had forsaken the spore-smothered, toxic surface of their own world and moved to Mars. Ere long, they would set to work to upset this thriving world of Earth, as they had the red planet, steal clean air and the waters of its seas, unless——

James Langton smiled quietly as he worked on through the night and all the next day—until the following midnight. Then he was finished; his calculations complete.

Untired, strangely, subtly different from an Earthling, he surveyed the huge mass of ultra short-wave transmitter, checked his figures for the last time, and closed the switches. He listened complacently to the droning of a powerful engine, pictured the radio waves leaping to the aerials on the mountainside above him, spreading out their energy through space, their frequency identical to that planned by one Veranicus Petlo untold ages before.

At the speed of light they spanned

the gulf of forty million miles—unseen messengers of destruction. They passed undetected across rust-smothered deserts, went through the south pole ice-cap, reacted on their destination—a complicated mass of machinery still in fair condition, deep within a power room under the ice.

A long sealed bolt slid back, released a cataracting flood that boomed through a long vent and out through sluices. A massive turbine reacted instantly, spun its huge shaft and rotated the dynamo. The armature spun swiftly between its magnets, building up horsepower upon horsepower. Electrical energy surged to the copper electrode, as yet only a quarter eroded, and dispelled itself into the water, instantly slammed across the network of canals, even through the very thin air itself, to the negative north pole which was partaking of the whole negative preponderance of Mars itself.

The canals, the air, became living fire, flaming energy. Five hundred Venusians, the last of their race, were instantly incinerated before they even realized what was upon them.

For sixty minutes the canals were deadly lines of force—then the sluice vent automatically closed, flooded the power room and, after a deeply sullen explosion, left only a dreary copper rod embedded lopsided in the ice.

Langton cut the power of his machine and flicked on the televisor. As he had expected, an anxious-faced announcer was already shouting hoarsely the news he had received from the Observatory.

"——and the canals of Mars, if canals they be, flamed blue for exactly an hour. The air, too, became blue, but now it is normal again. Can it mean a signal? The silver white substance is still visible near the Ismenius Lacus. Can it be life of——?"

Langton switched off and smiled faintly. "Silver white now—soon only rust," he murmured pensively. "Rust is the only thing the Red Planet has left——

"But there will be no theft of air and water from Earth. No more men from Venus, because they must have been the last——"

Rising to his feet he went to the door, opened it, and drew a deep breath of the sweet mountain air, stood bareheaded gazing toward a red star low down on the horizon. In that moment he was lost in memories, dim and cloudy, of a man who had been his remote ancestor——

One Viranicus Petlo. But now Viranicus Petlo was avenged——

Whispering Satellite

by

THORNTON AYRE

Discovered: the finest basso in the System!

ROCKED in the cradle of the deep,
I lay me down in peace to sleep
——"

The flawless, basso-profundo voice ceased. Clark Mitchell stopped hum-

ming the tune that had prompted those notes and looked up across the crude table toward the great, heavy-stemmed flower standing in the Saturnshine streaming through the window.

Sometimes he rather regretted the time two earth-years before when he had taught this particular product of Titan's Whispering Forest to sing. He knew it did it by air suction through its broad yellow face, vibrating in turn on hairlike vocal cords, but he'd never quite gotten over the uncanny effect of it.

Two years on Titan had done much to orient Clark into the strangeness of this little satellite flying round its primary in 15 days, 22 odd hours—a little desert island of a world, bathed in the torrid heat of Saturn 770,000 miles distant. Unlike Jupiter, the ringed world has cooled less swiftly and pours its warmth on its whole retinue of moons.

Of course, Clark hadn't come to Titan for pleasure. He'd been fleeing Earth when the thing had happened—a jammed recoil tube, a dizzy spin, then Titan—with his machine wrecked beyond repair. Fleeing Earth because a girl looked likely for putting him in a spot for a murder he'd never committed.

He smiled bitterly now as he thought of her—Nan Henshaw. He wondered how he'd ever come to love her in the first place; why, even he still loved her.

And now? Well, like any other marooned traveler out of the line of the regular space ways he'd done a Robinson Crusoe act and fixed himself up as best he could. He had such food as the jungle provided; his spaceship water equipment gave him water from the atmosphere. It was just a case of waiting—waiting for the day when he might possibly be rescued from this steamy, saturating wilderness with its thick, murmurous jungle and varying moonlight, primary-light and distant sunlight.

Of course, there were *vilictus* deposits somewhere to the north of the satellite —metallic compound of enormous value to Earth chemists in the making of explosives. Clark's ship detectors had revealed the presence of the deposits, but all his searchings had been futile. And the stuff was worth three thousand a gram! If outsiders ever heard of it, there'd be a second Klondike on Titan.

At least, he wasn't lonely. Basso, the singing plant, was company for one thing, and so were its weird subintelligent, singing contemporaries in the Whispering Forest outside. Then there was Snakehips, a true Titanian, actually an upright mass of quivering, darting gristle—entirely invertebrate—pretty intelligent so far as he went. His own race had their abode to the south of the little world, but mainly because Clark had once saved him from death at the hands of the *blue biters* he'd elected to stay with him ever after that.

Clark roused himself from his reflective mood as he thought of these things, ran a troubled hand through his crudely cut black hair. He glanced at the calendar on the wooden wall—20th July, 2614.

"Wonder how many more Julys are going to come and go on the earth-scale before I get out of this blasted hole?" he muttered. Moodily he studied the sky.

To the west, halved by the horizon, magnificent Saturn was slowly turning on his 10-hour revolution, the shadow of his rings, even to the bright streak of Cassini's Division, curving in a gray, arcing penumbra across his banded disk. In the east the ridiculous sun, shedding but 1-300th of the light normal on Earth, was nearly at the zenith. In other directions, at varied distances, Iapetus, Tethys and Hyperion were shedding their differing light-strengths according to their particular albedos.

He glanced toward the fantastic Whispering Forest and listened for a while to the weird, senseless chantings of the talking plants. Behind him, Basso began to

wail the bass aria from *Isis and Osiris* —— Clark twisted round in nervy exasperation.

"Oh shut up!" he screamed furiously. "Basso! Shut up, I tell you!"

SILENCE fell instantly. Basso's blossoms closed up timidly. Its sensitive organism responded instantly to human emotions. The forest, too, was suddenly subdued. As Clark turned to reenter the hut there came something else that made him halt. It was something apart from the notes of the forest—a deep, husky voice, unmistakably that of a human being!

"I tell you, Nan, that this is ridiculous! We're heading the wrong way entirely——"

The voice broke off. Two figures emerged from the jungle in the mixture of blue and green lights, one a slim girl and the other a rotund man of middle age. They were both attired in what had once been white, tropical clothes.

Seeing Clark, they stopped dead. He stared back at them with sagging jaw. It just didn't make sense! Nan Henshaw—*here?* And her father, too, the drunken old rascal——

"Clark!" the girl screamed suddenly. She raced joyfully across the clearing—too joyfully indeed. She overlooked the lesser gravity and fell sprawling in Clark's outthrust arms. Rather mechanically he steadied her, then dropped his arms slackly, surveying her pretty face with the dark hair peeping damply under the white hat.

"Of course this is a dream," he said hopelessly. "You just can't be real because——"

"Who isn't real?" snorted Henshaw, coming up and then leaning back so that his ample stomach protruded. He mopped his shiny brow vigorously. "I'd have you know, young man, that Nan has been searching space for you for two years! We tried everywhere, and Saturn's moons were the last hope. We saw your hut from the ship and landed over by a crazy-looking mountain range. Then we came through this forest." He looked back at it disgustedly. "Sure makes you plenty thirsty," he finished reflectively.

"You sound real enough anyway," Clark said dryly. He looked from one to the other of them. It was real enough all right, but the murder frame-up—— His lips tightened a little.

"Better come inside," he invited briefly. It felt good to speak to human beings again. "If we stop out here too long we're likely to attract the *blue biters*, and that means a whole lot of trouble. Their migratory period is about due."

He preceded them into the hut and kicked forward crude chairs.

"Sorry I've no highballs," he remarked, lifting a bottle of red fluid from his jumbled equipment. "Try this—it's *sephma* juice. Not bad, but highly intoxicating; roughly 50% alcohol basis."

The girl ignored the drink, but her father rubbed his hands complacently, sank down with a deep "Ah!" and mopped his face. The cork popped——

Quietly Nan took Clark's hands, looked at him seriously.

"Listen, Clark, I know what you're thinking—that I was responsible for you getting into that murder mess back home. But I wasn't! Honest, I wasn't! The minute I knew you'd left to wander around in space, I had father build a private machine and cruise around to find you. I thought long ago you'd met with disaster or something. Then as we studied Titan——" She stopped and her dark eyes were suddenly intense. "Clark, you *do* believe me, don't you?"

"You mean you were framed as much as me? That we were poisoned toward each other by idle gossip?"

"Just that," she nodded seriously. "The real murderer was found long ago. If I didn't love you, why otherwise would I search space for you?"

That was logical enough. Clark rubbed his roughly clipped hair ruefully. "Guess I've been a sucker, Nan —but somehow I never could quite figure how you turned out like that——"

He broke off and turned as Snakehips came quietly in. The girl drew back quickly. Her father lowered the bottle of *sephma,* looked at it doubtfully, then back to Snakehips—— The Titanian came forward on his rubbery feet—a 9-foot, upright worm, incredibly flexible, surprisingly human in main contours, with big, serious green eyes and a flapping mouth.

"*Blue biters* coming," he announced phlegmatically.

Clark started. "Then we've got to get away from here quick!" He turned to the girl. "Where exactly is your ship?"

"Beyond that funny mountain range that looks like"—she thought swiftly—"like knife blades!"

He nodded briefly and said: "Piano Key Range, eh? That's eight miles to the north——"

Henshaw interrupted him. "Just a minute! What the hell are these *blue biters?* And Piano Key Range?"

Clark grinned faintly. "I forgot you don't know the local geography. Piano Key Range is merely called that because of its resemblance to a keyboard. The *blue biters* is a name of my own for the technically classified *sapphiritus termite,* or blue ants of Titan. Damned deadly things," he went on seriously. "The white ants of Earth have nothing on them. They fly like locusts and eat every darn thing in sight. Periodically they migrate and eat all wood and flesh in their path; metals they leave alone."

"Mind if I take this *sephma?*" Henshaw ventured. "Good stuff to drink in case——"

"I'm drinking—drinking—drink-ing ——" rumbled Basso from the window.

Henshaw leaped up in sudden fright, then he shook himself unbelievingly at the sight of the humming plant. Clark gripped his arm.

"Come on, sir, we haven't a moment to waste—— Listen!"

They fell into quiet. Above the murmurings of the forest, there was a dull buzzing note, rising and falling in beating cadences, the whir of a million wings. The oblong of Saturn-and-Hyperion-light in the doorway began to dim.

"The *biters!*" Clark muttered tensely. "Clouds of 'em, blotting out the light —— We may make it yet! Snakehips, give us a hand!"

The Titanian sprang across the room in a lithe bound, but the only thing he did was to grip Basso, complete with pot.

"What the hell——" Clark demanded impatiently.

"Help," the Titanian said ambiguously, and Clark gave it up. Snakehips' ideas were beyond him.

CAUTIOUSLY, they all moved to the doorway—and met a humming barrier of flying, viciously biting shapes, half ant and half grasshopper in appearance, each about three inches long.

The heavy moist air was thick with the things; they crawled on the sloppy ground, smothered the walls and roof of the hut, were black in numberless myriads against the wild sky.

"Here's my gun, Clark," the girl said briefly, jerking it out of her pocket. "Five charges in it."

He took it from her, tossed his awkward provision pack further round his shoulders, then plunged forward. The girl and her father, he clutching his *sephma* bottle, floundered behind him. Both of them staggered in the weak gravity; Henshaw in fact was half intoxicated.

Immediately, all three of them were smothered in the little horrors. Teeth bit into every portion of exposed flesh, tore clothing to ribbons. Clark found

his hands mottled with drawn blood-specks.

"Run like hell!" he cried hoarsely. "They'll thin down in the forest because the flowers'll get 'em——"

Henshaw and the girl plunged beside him as he flayed round with a blast from the ray-gun. Behind him in the clouded light he saw his hut already smothered with *biters* as thickly as flypaper in midsummer. A thousand of the things vanished at the slash of the gun, but ten thousand refilled the gap.

Snakehips came slithering up, still holding Basso. "Basso help!" he cried in triumph. "Watch!"

He charged fearlessly through the thick of the flying mass, and for the first time Clark saw the idea, wondered why it had escaped him before. The singing flowers possessed lethal properties, a natural protection of nature against the frightful blue termite scourge. As an Earthly plant absorbs carbon dioxide and chemically alters it to its own uses, so the more intelligent plants of Titan utilized similar methods, but for protection—simply another facet of nature's endless adaptability.

Basso drew in a tremendous draft of the heavy atmosphere that set his vocal cord stem and face bulging—then he suddenly exhaled an evil-smelling vapor, the oxygen converted into a different molecular construction and highly poisonous. It was so strong it made both Clark and Snakehips stagger dizzily. But the scheme was successful. The *biters* fell quickly away from that mephitic area.

Again and again Basso inhaled and exhaled, and little by little the bitten, aching party staggered into the forest's depths. Here the attack fell away; the air was heavy with the stench of fetid vapors from the countless hundreds of singing flowers, all of them emulating Basso's methods.

They sank down breathlessly on the curious, spongy amalgam that was the ground. The vapors were less mephitic—their heads began to clear. Clark studied the innumerable blood spots on his bare skin.

"Poisonous?" the girl questioned, surveying her own bites.

He shook his head. "Fortunately, no. The termites overcome their prey by biting it in pieces; it's their only method. No venom. They scarcely need it," he added bitterly.

"Nice place to come to!" growled Henshaw argumentatively. "I've seen *zinrota* on Ganymede and *johercs* on Jupiter, but this lot's got 'em beat." He braced his nerves with a further draft of *sephma* juice, then peered hazily round the clearing. Finally he looked at the sinking sun. "Say, whadda we do when it gets dark?"

"It's never dark," Clark answered him. "One moon or the other is always over the horizon, so is some part of Saturn. We'll have light enough—and I think you'd better lay off that juice!" he went on seriously. "You're getting tight!"

"S' what? At leasht I'm happy," Henshaw grunted, and took another drink. Then he put the cork back in the bottle and closed one eye speculatively. He looked up again as Snakehips began to reveal signs of uneasiness.

He flexed his absurd body into all manner of positions in an effort to convey his alarm.

"What is it?" Clark asked sharply. He knew the Titanian's quick, natural ability to detect the unusual on his own planet.

"Ground-shift," he said awkwardly, stumbling over the unaccustomed words. "Ground-shift——"

"Ye're not foolin' me," Henshaw said complacently, half asleep. "It's another of—hup!—your funny names!"

Clark shook his head worriedly. He began to speak, then paused as Basso, standing in his pot near by, suddenly

raised his beautiful petalled face and began to sing:

"Sailor beware, sailor take care—danger is near so beware, beware—— Many brave hearts are asleep in the deep——"

Clark looked round him quickly, the girl with him. Basso wasn't singing that famous song for the sake of it; something had inspired it. Danger, obviously. Where? Clark looked at the other singing blossoms on every side. Their petalled faces were closing up in readiness for something unpleasant. Basso did likewise when he'd rumbled a final "Be—ware!"

Snakehips pranced frantically up and down. "Ground-shift!" he nearly screamed—then at a sudden quaking along the very floor of the jungle it dawned on Clark what was implied. Ground-shift! Earthquake! They were common on this insubstantial little moon with its plasmic upper crust and almost eternally shifting and changing understratum.

HE WAS ON his feet in an instant, briefly explained. The girl clutched his arm in dumb terror as a low rumbling growled under their feet and the huge blossoms of the singing plants began to quiver perceptibly.

'What *is* this——" Henshaw demanded in irritation, getting to his feet—but his sentence was cut short as the ground suddenly pitched mightily and hurled him, *sephma* bottle and all nearly twenty yards away in the weak gravity.

Clark clutched the girl and reeled helplessly away with her. They narrowly missed a falling section of singing plants, and got shakily to their feet in the midst of dense undergrowth.

Again and again the ground heaved. It was impossible to keep upright. In normal times the gravity was tricky enough; in a quake one was utterly at its mercy. Helplessly, clutching each other frantically, they spun round and round, came up hard against a natural tree and then whirled on again, caught now in the grip of a surging, superheated wind.

"What about father?" the girl cried huskily, bracing herself for a moment. She raised her voice and screamed "Father!"

There was no response from the lashing, collapsing vegetation. A row of singing plants went down with a twang like badly played harps. Of Henshaw, Basso or Snakehips there was no sign.

Clark began to speak to the distressed girl, but he was interrupted by yet another convulsion. The ground rippled again. Slipping and sliding, they escaped the very edges of a suddenly parting, new-born 50-foot chasm. There, ground and air heaved and twisted in a million insane furies. Half jumping, half falling, Clark and the girl blundered into the crumbling jungle's remoter depths——

Then suddenly—so suddenly it was almost a shock—everything was still. Broken branches creaked. The wind ceased, the concussions stopped. Half uprooted plants drooped sadly, others toppled over with dull tinklings as their roots snapped——

Nan sobbed unashamedly. "Oh, Clark, do you think that father was——" She couldn't finish. She buried her head on his chest.

Megaphoning his palms, he yelled at the top of his voice. As before, there was no answer—but his eyes saw something over the more distant, remaining trees that he kept to himself. A flock of *blue biters* were buzzing in a solid cloud over a solitary spot.

The flowers there had died in the quake—and the termites had nothing to oppose them. If Henshaw had survived the quake—which seemed unlikely from his silence—the *blue biters* would get him anyhow. Nor was it possible to get across that 50-foot chasm in time to save him.

Clark successfully concealed a shudder as he turned to the girl, raised her tear-stained face. "We've got to face it, Nan," he said gently. "Come on—chin up!"

Her lips quivered in a futile effort to smile. In silence she walked along beside him. Fifteen minutes later they left the remains of Whispering Forest and came out onto the Saturn-lit plain leading to the coldly white, perfectly even mountain range so fantastically named the Piano Keys.

Clark came to a halt and silently studied the stars, checking his direction for due north. As he had expected, the path lay through the Cleft of the Scissors—but when he came to look for it in the varied lights it wasn't there.

He stared intently, sudden fear at his heart. If the forked cleft was blocked, it meant climbing the Piano Keys, and that wasn't possible without equipment. Else circumnavigating Titan itself, which was as difficult.

Laying a hand on the girl's arm he said worriedly, "You're quite sure you brought your ship down beyond the Range?"

She nodded miserably. "Of course. We came through the Cleft——"

"That's just the trouble; I believe the quake's blocked it up. Come on."

The distance to the Piano Keys was probably five miles; the varied lights and changing shadows precluded any sureness. Clark judged that they reached the base of the lofty, upflung heights an hour later. Stopping, he looked round him in utter amazement.

The whole topography had changed. The Cleft of the Scissors had gone, yes, but in its stead was a gulf going down to an unknown depth, its floor lost in abysmal dark. To get through the range meant descending into that abyss and then traversing its floor.

Clark looked at the girl quickly. She was dry-eyed now; something of the sadness had gone from her face with the need to face this new problem.

"Down there?" she questioned, and he nodded gravely.

"Only way, I'm afraid. I'll go first. Watch your step. With a depth like this, despite the slight gravity, you could easily break your neck. Here goes!"

He eased himself cautiously over the edge to the first ledge and assisted the girl down. The entire great escarpment was fortunately on a slight incline; otherwise descending it would have been an impossibility. Even as it was, every move called for infinite caution. For one thing, the innumerable rocks that formed the ledges were by no means stable; for another the constantly conflicting light rendered judgment deceptive.

Two hundred feet down the descent, the slanting light of the moons and Saturn ceased. The two were obliged to stumble downward through a cold gloom, so cold it was biting in intensity through their thin, torn clothes. Clearly, the wind was blowing from some internal point of the satellite's cold interior—a contradiction only made possible by external warmth and internal cold.

After an apparent age of struggling, the girl suddenly stopped and pointed below.

"Look, Clark! What's that?"

He looked in puzzlement at a long line gleaming and sparkling faintly in the brilliance of the overhead stars. It almost resembled ice-facets, yet he knew that couldn't be. The air, though cold, was not down to freezing point. Besides, there was no water worth mentioning at this depth. What there was was all on the surface.

"No idea," he confessed at last, and resumed the descent.

It took them another slipping, fumbling thirty minutes to reach the chasm bottom. In silence they stood looking up at the lofty wall beside them, its upper half painted by the Saturnshine,

then they moved to that long line of brightness.

The moment they reached it, Clark only glanced at it, then let out a yell that echoed and reechoed between the towering walls.

"It's *vilictus!* A whole vein of it!"

"And?" Nan asked, unimpressed.

"And it's worth three thousand dollars a gram!" he said in rapture. "Oh, boy, think of it! Untold wealth! Just what I need to put me right when I get back to Earth. It took every penny I had to hire that spaceship of mine—— I knew this darned stuff was northward somewhere, but I could never find it. Obviously below surface, and the quake revealed it."

HE TUGGED out the ray gun from his pocket and fired. Great chunks of the brittle, diamondlike substance sailed through the air. The noise of the explosion boomed and rumbled to the heights above.

Clark began to jam his pockets with the stuff. The girl did likewise, filling the provision packs as well. By the time they had finished they couldn't possibly estimate the worth of what they had, and by interplanetary law it was all theirs, though the vein itself would belong to America, since that was Clark's birthplace.

They went on again at length along the ever-rising chasm floor, stopping only once to rest and eat. Then forward once more until at length they reached the level plain beyond the Piano Keys. Not very far away stood the deserted space machine.

"We made it," Clark said very quietly.

Nan agreed in a low voice; he knew what she was thinking—— Then he looked up sharply as a fairly large pebble dropped from the heights and struck him a glancing blow on the shoulder. In the slight gravitation it was trivial, but——

"Great heavens, *look!*" he shouted desperately, pointing upward.

The girl only glanced, but immediately she screamed. An avalanche was beginning! Part of those lofty mountain heights, evidently shifted by the recent quake, was breaking free. Stones, boulders and dust were falling with apparent slowness—but by the time they reached the ground they would be traveling at dangerous velocity.

"Back! Back down the chasm!" Clark yelled. He clutched the girl's arm as he spoke and they hurled themselves at top speed down the incline up which they'd come.

Even as they ran, the first stones thudded and hammered around them. One hit the girl on the back and sent her sprawling on her face, but she was up again almost instantly, running as never before, until at last sheer lack of breath brought her to a gasping halt. Panting, Clark stopped beside her.

They looked back just in time to see numberless tons of white, powdered rock come crashing down at the far end of the incline, rocking the very floor with the concussion, spreading a vast choking haze of dust that set them coughing furiously. Then with the minutes, the disturbance began to settle.

"Gosh, that was close!" Clark breathed, his face tense and dusty in the reflected starshine. "Good job it didn't block the chasm opening. Only fallen to one side of it."

"Think the ship will be all right?" the girl questioned anxiously.

"No reason why not. It was a good distance from the line of fall."

They turned to return up the slope, then they paused in complete bewilderment. Clearly to their ears came singing—clear cut and profoundly deep, echoing against the walls!

"—and all day long the precious draft I'm drinking—drinking—drink-ing——"

"Basso!" Nan gulped in amazed re-

lief. Then she frowned. "But how did he get this far? He can't walk——"

"Unless Snakehips——" Clark began, but he paused as an undeniable human voice, congested with liquor and much fainter, tried to take up the same refrain and failed miserably.

"It's father!" the girl screamed hysterically. "It's father! He's alive!" She shouted hoarsely, "Father, is that you?"

A reply floated out of the darknesses of the chasm, far down the long incline.

"Course itsh me, girlie. An' why shouldn't it be, I'd like to know? Aw, c'm on now, letsh have it again—I'm drinking, drinking, drink——" He finished in a throaty gurgle.

"What in Heaven——" Nan started in bewilderment, then at that moment a figure came reeling into view, a figure in soiled white, hat on the back of his head, shiny face faintly visible. In one hand he clutched the now empty bottle of *sephma* juice, and in the other the pot containing the deeply singing Basso. Something else merged up like green grease paint. It was the faithful Snakehips.

Snakehips came forward eagerly. "Heard shot. Came," he said briefly from his great height.

Clark frowned. "Shot? Oh, you mean the ray gun when I cut off those *vilictus* chunks? It guided you here?"

Snakehips nodded. Nan went over to her father and shook him violently. "Father, listen to me! Are you hurt?"

"Snot a bit," he confided in a whisper, and she jerked her face away at the garlicky reek. "Never felt better—hup!—in my life!" He waved an arm to prove it and nearly overbalanced. Clark caught him tightly.

"Listen, Mr. Henshaw; how'd you escape the *blue biters?*"

Henshaw chuckled thickly. "I fooled 'em! Easy! They bit me an'—an' left me alone——" His eye closed significantly.

"Left you alone!" Clark cried. "That's impossible!"

"Oh, so you call me a liar, huh? Wanna fight——"

"Forget it," Clark said briefly, and signalled to the girl. Between them they marched the arguing Henshaw up the incline, still clutching pot and bottle tenaciously. Once they circled the remains of the avalanche they stopped again.

"Come to think of it," the girl said, "we'd have missed father if this avalanche hadn't turned us back. And then we mightn't have known but for the range of Basso's voice—— Why Clark, whatever's the matter?"

He was grinning amusedly. "Just been thinking about your dad's escape from the *biters*. Sure they'd leave him alone! He's drunk so much *sephma* juice his blood stream is charged with alcohol. Alcohol is utter poison to them, even in the minutest quantity. Like—like bathing insect bites with beer back on Earth," he finished reflectively. "Gosh, it was lucky he got drunk. It saved his life."

"And Snakehips led him?" the girl said eagerly.

"Snakehips did," the Titanian acknowledged. "Man here was asleep when—when you called. I carry him down chasm in jungle. Not deep, but wide. Carried him most times down wall here——" Snakehips' huge eyes saddened momentarily. "Miss you," he said simply, then suddenly turned and went off into the gloom of the lower incline, heading back undoubtedly for his own distant people.

"Well, swat we waiting for?" Henshaw asked disagreeably. "I wanna sleep——"

He slept all right—slept until the ship had pulled well clear of Titan and was on the earthward run. But he spent the greater part of the journey trying to pitch his voice as phenomenally low as Basso.

ROCKET FLIGHT

by
LEO VERNON

A science article on the mathematics of rockets by an M. I. T. mathematician

ROCKETS *can* fly. There is no doubt about that. It has been proven often enough by physical experiments. It has been proven that they can fly in the absence of air or atmosphere of any kind. The questions that must be asked about rockets are: What are the conditions that must be satisfied for rocket flight? What are the important factors in rocket flight? If these two are answered a third question is: What will be the performance of a rocket ship?

It would appear that these questions could be answered in the most part by experimenting, trying out rockets, and building still more rockets. They could be, but unfortunately most work of this type seems to be carried on in a very haphazard manner. With the exception of Professor Goddard's experiments in this country and a few in Europe, most work seems to be simple trial and error. The articles and books that are available in even the most complete libraries show this. So many statements about rockets are conflicting, many are obviously inaccurate or incorrect, and almost all seem to show wishful thinking.

Although one way of starting to answer these questions is by mathematical analysis, the mathematics will not give a complete answer. The results must be tested later by experiment—not because the mathematics may be wrong, but because *there may be factors which* were left out of the problem. The mathematics may, however, save a lot of time by showing some of the necessary conditions and explaining the exact nature of rocket flight. It can save experimenters unnecessary work. But it will not say anything about methods of building the rocket or give any magical answers. It will show clearly and simply why rockets fly, how they fly and, by extension, show some of the problems that will face pilots and designers of rocket ships when they are developed in the future.

The mathematical problem of rocket flight is essentially simple, even though some advanced math is necessary for the final answers. The method of approach, the problem itself, can be stated in ordinary terms. The math is only a shortband for writing down the ideas that are developed. The problem is tackled in the same way as any other problem in mathematical physics. First it is necessary to study the mechanics of the rocket and determine just what makes it fly. Then, having learned what happens, state the problem in a simple form and write it down, using algebraic symbols. This equation can be solved and the answer written out. Then, if numbers are substituted for the letters in the equation, it is just a problem in arithmetic to discover how a rocket will behave.

Obviously the simplest problem in-

When rackets fly, it will be easier to train mathematicians to fly, than fliers to perform the needed calculations.

volves just the rocket itself. Imagine that the rocket is out in free space, where there is no atmosphere or any gravity. This, of course, is a practical impossibility. But it is simpler if we imagine the rocket is there and determine how it would behave. The first question before us is: What makes the rocket move?

To any one who has watched ordinary skyrockets on the Fourth of July, or has blown up a balloon to release it and watch it darting through the air, it is clear that the flight is connected somehow with the matter being expelled from the rear of the rocket. Actual matter with a definite mass, be it solid particles like dust or gases, is thrown

out of the rocket by explosions or by pressure and the rocket moves in the opposite direction.

These facts can be observed. We want to know if they can explain the flight of the rocket and if the explanation is reasonable. The statement of the observations makes us think at once of Newton's Third Law, "For every action there is an equal and opposite reaction." This law can be stated in quite a number of different ways without changing the fundamental meaning. One of the most common is to say that the forces involved in any problem must balance exactly. If—for instance—a football is kicked, the football is pushed forward with a definite force by the foot. But the football pushes back on the foot with an exactly equal force. This might appear to be an easy form in which to use the law, but difficulties arise in describing the forces algebraically.

A second, better way to use the Third Law is to substitute momentum for force. By definition, the momentum of an object is equal to the mass of that object multiplied by the velocity with which it is traveling. Then we can say that the momenta will balance exactly. If we remember that velocities can be positive or negative—that is, backward or forward—we see that this is really nothing but an old friend from physics, the principle of the conservation of momentum.

THE APPLICATION of the Third Law is shown most easily by an example. Suppose that you are seated on a sled on very smooth ice with a pile of bricks on the sled with you. Throw a brick toward the rear, and the sled will move forward. The brick which was heaved off has a definite, measurable momentum. According to the Third Law, the sled will have the same momentum. The brick, weighing comparatively little but traveling at a high velocity, has the same momentum as the sled. The sled, weighing quite a bit, will move off at a lower velocity. Friction with the ice will eventually stop the sled. But as long as the bricks hold out the sled can be kept moving.

Applying this now to the rocket, exhaust is expelled from the rear of the rocket. Suppose that the mass of the material tbrown out in the exhaust is "m" and that it is expelled with a velocity "v". Then the momentum of the exhaust is "mv". If we call the mass of the rocket "M" and the velocity of the rocket "V", the momentum of the rocket will be "MV". By the Third Law, these two must be equal, or $mv=MV$—a simple algebraic equation. Suppose we start with a rocket weighing ten pounds—including fuel—and expel one pound of the fuel with a velocity of one hundred feet per second. The momentum of the exhaust will be 1×100. There are nine pounds of rocket left since one pound was expelled. Therefore $1\times100=9\times V$, and we learn that the rocket will have a velocity $V=11.11$ feet per second.

This shows that the flight of a rocket can be explained and that the physical ideas involved can be expressed mathematically. It is the simplest possible case of the rocket principle—one chunk of matter being thrown out at a time. In the actual rocket the problem is more complicated, since there is a continuous stream of exhaust and the mass of the rocket is changing every instant. To handle these continuous changes it will be better if we try using Newton's Second Law, since this has to do with changing quantities.

It is in the application of the Second Law that more writers seem to have gone wrong than in any other part of the study. In a way the mistakes are excusable since most textbooks state the law either incorrectly or only partially. The way Newton first wrote the law can be translated from Latin as: "The

rate of change of motion is proportional to the force applied." In modern physical terms this would read: "The rate of change of momentum is proportional to the force applied."

Before discussing the mistakes that are made, let's look at this law carefully. It introduces a new idea, "rate of change." In Newton's time rates of change had been known but nobody had worked out a mathematics for them. As a consequence Newton had to invent the differential calculus. The calculus can be complex at times, but it must be remembered that it follows definite rules just as does arithmetic.

Newton's law speaks about the "rate of change of momentum." Now momentum is mass multiplied by velocity, so we have the rate of change of "mv". This is the point at which difficulties arise. If—and this is an important "if"—the mass is constant, doesn't change under any conditions, then—and only then—is it correct to say that this equals mass multiplied by rate of change of velocity. In the case of relativity mechanics, or in the case of rockets, the mass changes. When the mass changes, we have to use Newton's original form.

Many textbooks forget to mention this and simply write the Second Law as mass times rate of change of velocity, or mass times acceleration. That is true only if the mass remains constant. In a rocket it does not, so we have to use rate of change of momentum. This is the mistake a good many people have made. They didn't use the correct form of Newton's Second Law.

The real complications of the rocket problem show up in the application of the Second Law. Two things are necessary: We must learn in what manner the mass of the rocket changes with time, and we must discover a way of stating the forces applied to the rocket. Both of these things can be done if we know two factors: the rate at which fuel is used up, and the velocity with which the exhaust is thrown out of the rocket.

THESE can be done, and proven, as the mathematician would say, "rigorously." If we pick out different letters to represent these different quantities, it is possible to write down equations that describe what happens. We can let the letter "m" stand for the mass of the rocket at the beginning of the flight. This will include the weight of the fuel and everything. Then let the letter "k" stand for the rate at which fuel is used. It can be measured, say, in pounds per second. Next we can let the letter "X" mean the velocity with which the exhaust is expelled. "X" will be measured, for example, in feet per second. Finally we can let "v" be the velocity of the rocket and "t" be the length of time since it began the flight. Then the equation which describes the motion is:

$$(m—kt)dv/dt—kv=kX.$$

This is what is known as a differential equation. Fortunately, it is one of the few that can be solved easily. The answers are:

$$v=X(m/(m—kt)—1)$$
$$s=X(m \log m/(m—kt)—kt)/k \ *$$

where the letter "s" stands for the distance the rocket travels.

These results are not as complicated as might have been expected, but they differ considerably from those obtained by some writers on rocket flight. They can be used by substituting numerical values for the different quantities, doing a little arithmetic and finding just how the rocket would behave.

A good way of testing these results numerically for comparison with other results is to work out how much fuel must be used to make the rocket travel at a velocity equal to the velocity of the exhaust. That is, how much fuel must

* Here, "log m" refers to the logarithm of "m" on the Natural System, based on "e", where e=2.71828

be used to make V=X? This is easily solved in our case, and we find the answer to be kt=m/2.

This means that "kt" is equal to the amount of fuel used and "m" is the original weight of the rocket, including fuel. Then one half the original weight of the rocket must be used up to make the velocity of the rocket equal to "X". To stop the rocket would take one half the remaining weight. It appears from this that the exhaust velocity is an important value in rocket flight. We should try out some numerical values.

Willey Ley* mentions some values for exhaust velocity of around ten thousand feet per second. This may seem a high velocity, but compared with solar distances it is really quite low. Making use of this value, though, suppose we start with a rocket weighing one ton when fueled at the beginning of the flight. How much fuel will be needed to make that rocket travel at a velocity of ten thousand feet per second? The answer at once is that it would take one half ton of fuel and there would be only half a ton of rocket *and* fuel left to get the rocket traveling at ten thousand feet a second—less than two miles a second. It would take one half the remaining mass to bring the rocket to a stop, or one quarter ton of fuel to stop what was left of the rocket and fuel. There would still be the problem of getting back to the starting point.

Nothing has been said about how long it would take, because that would depend entirely on the mechanism, how fast the fuel was used up and the value of "k". In the present case, where there are no opposing forces of gravity or friction, this rate is of little importance. The amount of fuel needed to bring the rocket to a given velocity is always the same.

IT BECOMES still more apparent that the exhaust velocity is all important, that this is the field in which experimentation is needed. Ley, in the previously quoted article, has stated that the theoretical limit for exhaust velocity is only sixteen thousand feet per second, though he gives no proofs of this. We must not forget, either, that the problem above has been worked out for ideal conditions with no opposing forces. Before going any further with speculations it would be advisable to find out what effect these other forces would have. That is, we must put the force of gravity into the equation describing rocket motion.

The force of gravity has been measured very accurately and can be stated simply and explicitly. Gravity may be described as that property of mass which results in a pull on any other mass, the force being directed toward the center of the mass. Although there are many ways of stating this and various minor corrections under special conditions, as in relativity, we can afford to ignore these fine points and speak only of ordinary factors of gravity of normally large magnitude.

This force has been measured by numerous experiments and found to depend upon the mass of the planet, the distance from the center of the planet, the mass of the rocket or other body studied and a constant "g" known as the Gaussian constant.

Once again it is possible to write out an accurate differential equation that will describe the motion of the rocket when we ignore atmospheric friction and suppose that the rocket travels in a straight line out from the surface of the planet. The equation is:

$$(m-kt)dv/dt-kv=kX-g(m-kt)M/r^2$$

where the letter "M" represents the mass of the planet from which the rocket

* "The Dawn of the Conquest of Space," Astounding Stories, March, 1937.

starts and "r" the distance from the center of the planet.

This is one of the more unpleasant kinds of equation. To be technical, it is a nonhomogeneous, nonlinear, second-order, differential equation. A mathematician who is solving it just for fun can write down a bunch of symbols and say, "It's solved!" But when it comes to putting in numerical values and getting results out, things get complicated. In fact, it is impossible to write down an absolutely exact numerical solution. It requires the use of a well-known mathematical dodge—the infinite series.

What this really means is that we can write out an expression which is almost the answer, but not quite. Then we add onto that another expression. The sum of those two is quite a bit closer to being the exact answer. Then we add on a third. The sum of all three is still closer. Each piece we add on is small, each succeeding piece, smaller. If we added an infinite number we would have an exact answer. In principle it is the same as expressing the fraction one-third as a decimal. It is close to the correct value if we write 0.3. It is still closer to write 0.3+0.03=0.33. And it is still closer to write 0.333333. To be exact would require an infinite number of smaller numbers added on in this way.

In our solution the first three or four parts are usually sufficient because they will be correct within one per cent. The results can, of course, be carried on and on until the patience of the computer vanishes. This computer's patience wore very thin with the sixth term, so that was all that was used in computing some of the results given later in this article.

These results, shortened as they are, are pretty bad. But they are mild examples of the problems rocket pilots of the future will have to solve in a hurry. For accurate navigation, the longer form will have to be used. The third term contains four factors, the sixth contains seven. If the rocket is not stationary but is moving at the beginning of the flight, there will be 27 more terms to add on.

At least, this answer is in a form that can be used arithmetically and which applies to any planet. Of course, it applies as yet only to cases in which the rocket goes straight out from the surface—with the rate of burning fuel a constant—and ignores atmospheric friction and the rotation of the planet. These factors would make the answer ten times as complicated, though such solutions can be obtained. Nevertheless, there is plenty of meat to be found in this solution.

TO apply it, let us imagine a rocket starting from Earth's surface and introduce actual numerical values in the equations. Since this is none too easy for arithmetical work, even with the aid of a calculating machine, let's take round numbers whenever possible and use metric units.*

First there are the constants. Any place in the universe, as far as is now known, the Gaussian constant $g=6.6667\times10^{-8}$ dynes—the metric unit of force. For the Earth, the mass $M=6.16\times10^{27}$ grams, and the average value of the distance from the center of the Earth to the surface is $r=6.371\times10^{8}$ centimeters.

Next it is necessary to assume some reasonable values for the rocket. Made of steel, with moderately thick walls,

* Factors for converting metric to U. S. units can be found in almost any physics textbook, or in any good dictionary. One additional advantage can be obtained in calculating by using the system of writing very large or small numbers as powers of ten. For example, 10,000 can be written more easily as 10^4, or $10\times10\times10\times10$. One billion would be written as 10^9, and two billion five hundred million as 2.5×10^9. For small numbers, divide by powers of ten, writing $1/10^4$ as 10^{-4}. Thus 0.00000003 would be 3×10^{-8}. Also, $10^6\times10^7=10^{13}$.

space for one or two men and lots of room for fuel tanks, it is possible to design a rocket which would weigh around 22 tons. Using the best fuel now available—hydrogen and oxygen—there would be room to cram in 88 tons of fuel if it is packed under a pressure of 6,000 atmospheres. Higher pressures, to get in more fuel, would require much thicker walls for fuel tanks and an increase in weight of the empty rocket. 6,000 atmospheres is within the scope of modern engineering practice for pressure and for tank construction. It appears, then, that the best that can be hoped for, working from rough designs, is 22 tons of rocket and 88 tons of fuel; a total of 110 tons, or about 10^8 grams.

Next is the velocity of exhaust. It has been claimed that the best obtainable with a hydrogen-oxygen mixture is a value of X=16,000 feet per second—about 5×10^5 centimeters per second.

There is no way of guessing how rapidly the fuel must be burned. We can, however, calculate a minimum value by finding how much "k" must be to barely lift the rocket off the surface. Going back to the solution for "s" we find the necessary condition is that $k=gmM/Xr^2$. Putting in numerical values, k=202.4 kilograms per second, or about 447 pounds of fuel a second. Burning fuel at this rapid rate would not send the rocket flying off into the air. It would barely take the weight of the rocket off the ground at first. Yet at this rate, all the fuel would be burned up in less than 500 seconds. To send the rocket right off would require a much higher rate of fuel consumption, but then propulsion could be used only for a proportionally shorter period of time, and would be equally efficient.

WHAT are we to deduce from this? First we might try putting more fuel in the rocket, but probably everybody will agree that it would be unreasonable to have more than 4/5 the original weight made up of fuel. The second is that it will be best to try to increase the exhaust velocity. The third is the observation that it is advisable to get up and away as quickly as possible. The slower the rocket starts, the better chance gravity has to act on it and pull it back—with the consequence that still more fuel will be needed to build up to a high velocity.

It really looks as if the vital factor is exhaust velocity. With the present experimental values given by Ley, it would be possible to get a rocket up at fair velocity. But it couldn't go very far out and have enough fuel left to make a decent landing. That won't prevent us, though, from using our imaginations. It is always possible that in the not-too-distant future experimenters will find that higher exhaust velocity. When they do, then what can rockets do?

The solutions given above will answer that question. Some calculations have been made to show what distance the rockets would travel and how fast they would be going with different values of "k" and "X". These are calculated on the basis of a rocket leaving the surface of the Earth, going out in a straight line from the center and assuming a constant rate of burning fuel. The rotation of the Earth and air resistance have still been ignored to reduce complexity.

In Table I the top line gives the time in seconds from the beginning of the flight. In the left hand column are listed different sets of values of the exhaust velocity "X" in kilometers per second (1 kilometer about 5/8 mile) and the rate of fuel consumption "k" in kilograms per second (1 kilogram is about 2.2 pounds). In the main body of the table are the distances in kilometers that the rocket would travel during dif-

ferent times. In Table II the velocities in kilometers per second are given in a similar way.

TABLE I

	10	50	100	200	300	500	1000
X= 50 k= 30	0.244	6.10	24.6	101.0	232.9	678	2410
X= 50 k= 40	0.494	12.35	50.0	206.2	479.6	1418	5580
X= 50 k= 60	0.994	24.85	101.4	421.4	989.6	3038	14460
X= 50 k= 90	1.744	43.60	179.7	759.8	1827.1	5996	37930
X=100 k= 60	2.494	62.35	254.4	1056.1	2477.3	7612	
X=500 k= 60	14.494	362.35	1478.4	5669.9	14379.0	44204	

For example, if k=90 kilograms per second and X=50 kilometers per second, we can see that after the rocket has been flying for 300 seconds it will have traveled 1827.1 kilometers and will have a velocity of 13.437 kilometers per second.

TABLE II

	10	50	100	200	300	500
X= 50 k= 30	0.0488	0.244	0.494	1.040	1.615	2.85
X= 50 k= 40	0.0988	0.494	1.006	2.123	3.377	6.13
X= 50 k= 60	0.1988	0.994	2.048	4.371	7.044	13.51
X= 50 k= 90	0.3488	1.744	3.597	8.009	13.437	28.07
X=100 k= 60	0.4988	2.494	5.138	10.944	18.604	33.92
X=500 k= 60	2.8988	14.494	29.858	63.528	102.08	197.18

With the data given in these tables as a guide the imagination can roam at will, testing all types of conditions for rocket flight on different planets. These are still for ideal conditions. One important factor is air resistance, but a little thought shows that this needn't be so important after all. A decently constructed rocket will be very well streamlined.

The tabulated data shows that the velocity under ordinary conditions won't become very great until the rocket is 5 miles or more up, and by that time the greatest portion of the atmosphere has been passed. Of course, the atmosphere extends much higher, but above five miles it is very thin. The exact effect of air resistance is too complicated to compute with any great accuracy. It is only possible to say that with these velocities it varies approximately with the cube of the velocity. A good guess is that it would not reduce the values in the table by more than five per cent.

Another factor to be considered if there are humans in the rocket, is the acceleration. It is well known from airplane tests that man cannot hope to function properly and quickly if the acceleration is much more than four or five times that caused by gravity at the surface of the Earth. It is possible to calculate the value of the acceleration under any of the conditions listed by referring back to the equation of mo-

tion and solving it for dv/dt—the acceleration. The acceleration of gravity is about 980.60 metric units. Making these calculations, it is seen that acceleration gradually increases with the time, making it necessary to reduce the rate at which fuel is being consumed. This is rather an annoyance, because it requires computing the results all over again from the beginning each time the rate of fuel consumption is changed. It can be done, however, if the computer doesn't run out of paper.

THE RESULTS obtained in this article can be summarized briefly. It was shown first that there is a clear mathematical statement of how and why a rocket flies. Then equations describing the motion of a rocket were developed and solved. The solutions, on study, showed what are the most important factors in rocket flight and indicated what is the most important field of experimentation. The solutions do not tell anything about the methods to be used or how to build the rocket. They do show the importance of the exhaust velocity,

A practical conclusion drawn by the author is that for actual flight into space, with a chance of getting back safely to Earth, he would want to be guaranteed an exhaust velocity of at least 160,000 feet per second before entering the rocket.

Mathematically, this problem is by no means completed. There are many more fascinating equations to be solved and numerical results to be examined. There is the question of how the rocket would behave if an automatic control were placed on the throttle, mechanically changing the value of "k" so that the acceleration would remain constant throughout the entire time of propulsion. Then there is the curious, but small effect of the rotation of the Earth, including the latitude and altitude from which the rocket starts and the centrifugal force this involves. It won't help the rocket very much, but the effect on the course will be important to the pilot of the future.

Then again, there is the effect of Sun and Moon gravity. These were not considered above, since they greatly complicate the solution. The Sun's gravity won't become important until the rocket has proceeded quite a distance. Solar gravity just balances Earth gravity at a distance of about 160,000 miles from the center of the Earth. After the rocket gets out that far, the Sun pulls on it harder than does the Earth, but then the effect of the Earth revolving around the Sun enters as still another factor. Also, the pilot will be faced with a neat problem in picking the path from one planet to another, using the minimum amount of fuel.

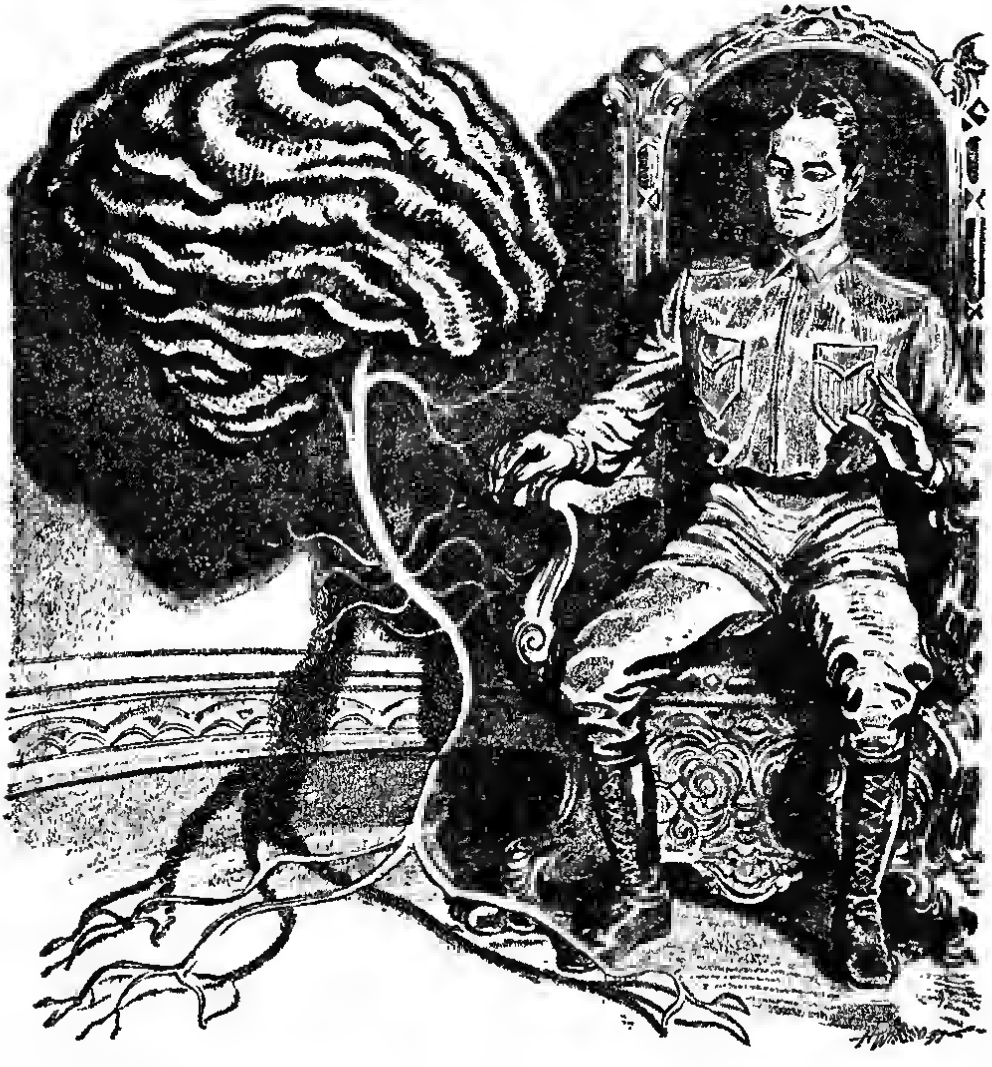
Even though interplanetary flight is not with us yet, there is plenty of fun available for the arithmetician right now. For instance, what correction must be applied when the exhaust velocity is so great that its mass changes according to relativity theory? And if the exhaust velocity approaches the velocity of light and mass becomes infinite, what happens to the rocket? Will it need *any* fuel after it starts?

Galactic Patrol

by

E. E. Smith, Ph.D.

Continuing Dr. Smith's greatest novel



UP TO NOW:

Law enforcement lagged behind crime because the police were limited in their spheres of action, while criminals were not. Therefore, when the inertialess

He willed with all his force to see him as he really was. And instantly—the scholarly old man subsided into a brain.

drive was perfected and commerce throughout the galaxy became a commonplace, crime became so rampant as to threaten civilization. Thus came into being the Galactic Patrol, an organization whose highest members, the Lensmen, are of unlimited authority and range. Each is identified by wearing the Lens, a pseudo-living, telepathic jewel matched to the ego of its wearer by those master philosophers, the Arisians. The Lens cannot be either imitated or counterfeited, since it glows with color when worn by its owner, and since it kills any other being who attempts to wear it.

Of each million selected candidates for the Lens, all except about a hundred fall before the grueling tests employed to weed out the unfit. Kimball Kinnison graduates No. 1 in his class, and is given command of the space ship Brittania. He is informed that the pirates, or Boskanians, are gaining the upper hand over the patrol because of a new and almost unlimited source of power, and is instructed to capture one of the new-type ships of the pirates, in order to learn the secret of that power.

He succeeds in getting the information, but cannot transmit it to Prime Base because the pirates are blanketing all channels of communication. Boskonian ships are gathering, and the crippled Brittania can neither run nor fight. Each man is given a spool of tape bearing the information, and all take to the lifeboats.

Kinnison and VanBuskirk—a Valerian, and therefore of enormous size and strength—land upon a practically unknown planet, Velantia. They aid Worsel, a scientist of that planet, in destroying a mentally parasitic race; then all the resources of the planet are devoted to the preparation of defenses against the expected Boskonian attack. Several others of the Brittania's lifeboats reach Velantia. Kinnison traces a communicator beam of Helmuth, who "speaks for Boskone," thus getting his first line upon Boskonia's Grand Base.

Six pirate vessels are captured. In the six ships, manned by Velantian crews and now blanketing the pirates' own communicators, the patrolmen set out for Earth and for the Prime Base of the patrol.

Kinnison's Bergenholm, the generator of the force which neutralizes inertia, breaks down. He is therefore forced to land upon Trenco—the planet upon which is produced thionite, the deadliest of all habit-forming drugs—for repairs, before he can go on toward Earth.

Helmuth, the Boskonian, goes to Arisia in an attempt to find out what the Lens really is, to give the Lensman such power. He is punished severely, mentally, by the Arisians, but is allowed ta return to his Grand Base, alive and sane.

Kinnison, after a spectacular battle in the Earth's stratosphere, reaches Prime Base with his precious data.

By building ultra-powerful battleships, called "maulers," the patrol gains a temporary advantage over Boskonia, but a stalemate soon ensues. Kinnison develops a plan of action, in the pursuit of which he scouts a pirate base upon Aldebaran I. In a fight with the Wheelmen of that base he is seriously wounded.

XVII.

KINNISON did not lose consciousness—quite. There was too much to do, too much that *had* to be done. He had to get out of here. He had to get back to his speedster. He had, by hook or by crook, to get back to Prime Base! Therefore, grimly, doggedly, teeth tight-locked in the enhancing agony of every movement, he drew again upon those hidden, those deeply buried resources which even he had no idea he possessed. His code was simple: the code of the Lens. While a Lensman lived he did not quit. Kinnison was a

Lensman. Kinnison lived. Kinnison did not quit.

He fought back that engulfing tide of blackness, wave by wave as it came. He beat down by sheer force of will those tenderly beckoning, those sweetly seducing arms of oblivion. He forced the mass of protesting putty that was his body to do what *had* to be done. He thrust styptic gauze into the most copiously bleeding of his wounds. He was burned, too, he discovered then—they must have had a high-powered needle ray on that truck, as well as the rifle—but he could do nothing about burns. There simply wasn't time.

He found the power lead that had been severed by a bullet. Stripping the insulation was an almost impossible job, but it was finally accomplished, after a fashion. Bridging the gap proved to be even a worse one. Since there was no slack, the ends could not be twisted together, but had to be joined by a short piece of spare wire, which, in turn, had to be stripped and then twisted with each end of the severed lead. That task, too, he finally finished, although he was working purely by feel and half conscious withal in a wracking haze of pain.

Soldering those joints was, of course, out of the question. He was afraid even to try to insulate them with tape, lest the loosely twined strands should fall apart in the attempt. He did have some dry handkerchiefs, however, if he could reach them. He could, and did, and wrapped one carefully about the wires' bare joints. Then, apprehensively, he tried his neutralizer. Wonder of wonders, it worked! So did his driver!

In moments then he was rocketing up the shaft, and as he passed the opening out of which he had been blown, he realized with amazement that what had seemed to him like hours must have been minutes only, and few even of them. For the frantic Wheelmen were just then lifting into place the temporary shield which was to stem the mighty outrush of their atmosphere. Wonderingly, Kinnison looked at his air gauges. He had enough—if he hurried.

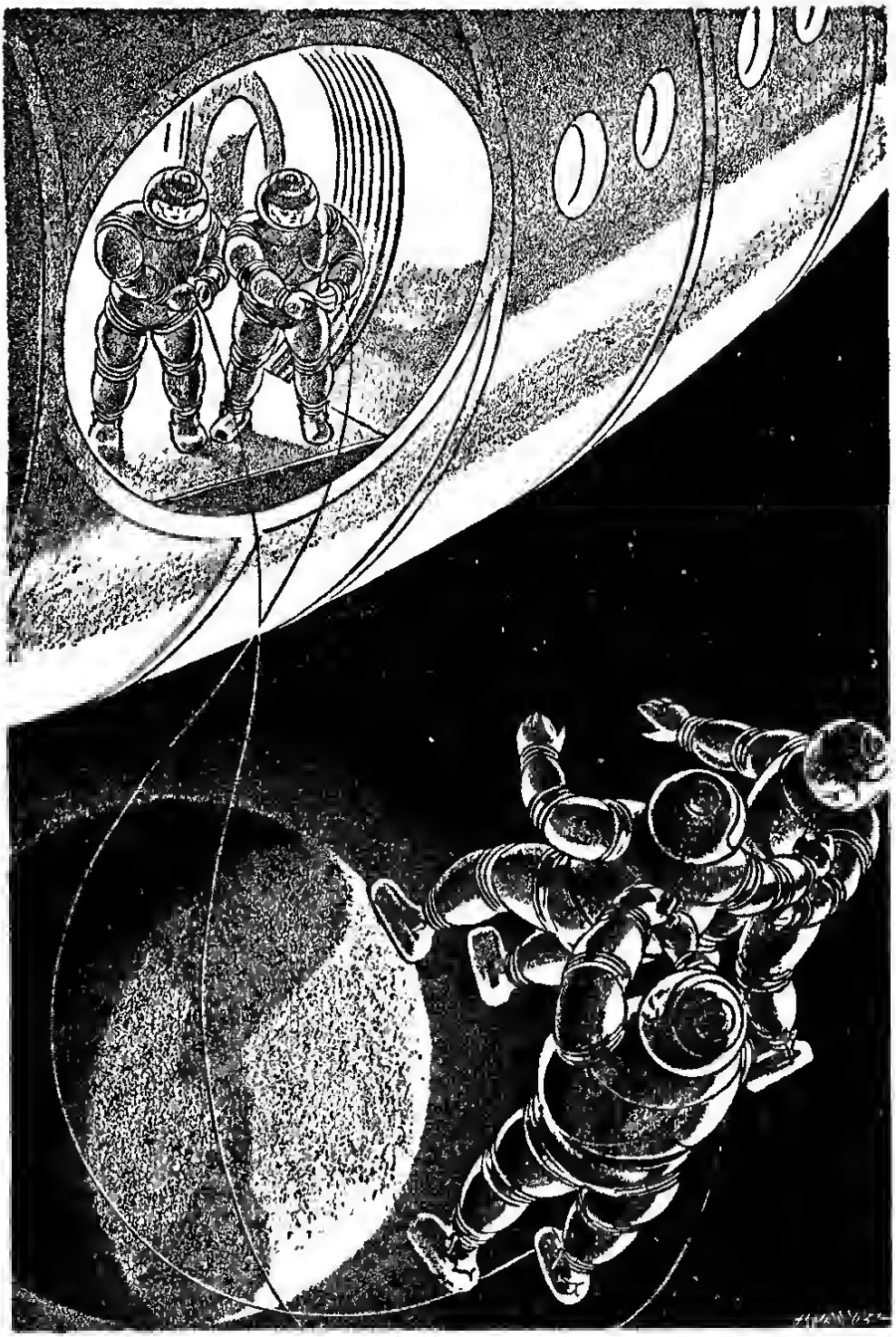
And hurry he did. He *could* hurry, since there was practically no atmosphere to impede his flight. Up the five-mile-deep shaft he shot and out into space. His chronometer, built to withstand even severer shocks than that of his fall, told him where his speedster was to be found, and in a matter of minutes he found her. Against her side he flashed in inertialess collision. He forced his rebellious right arm into the sleeve of his armor and fumbled at the lock. It yielded. The port swung open. He was inside his own ship.

Again the encroaching universe of blackness threatened, but again he fought it off. He *could not* pass out—yet! Dragging himself to the board, he laid his course upon distant Tellus, too distant by far to permit of the selection of such a tiny objective as Prime Base. He connected the automatic controls.

He was weakening fast, and knew it. But from somewhere and in some fashion he ***must*** get strength to do what ***must*** be done—and somehow he did it. He shoved his levers out to maximum blast. Hang on, Kim! Hang on for just a second more! He disconnected the spacer. He killed the detector nullifiers. Then, with the utterly last remnant of his strength he thought into his Lens.

"Haynes." The thought went out blurred, distorted, weak. "Kinnison. I'm coming—com——"

He was done—out cold, utterly spent. He had already done too much—far, far too much. He had driven that pitifully mangled body of his to its ultimately last possible movement; his wracked and tortured mind to its ultimately last possible thought. The last iota of even his tremendous reserve of vitality was consumed and he plunged, parsecs deep, into the black depths of oblivion which had so long and so unsuccessfully been trying to engulf him.



Then two husky pilots played the armored figures on the steel cables as an angler plays a fish, aiding the struggling drivers to overcome the velocity.

BUT KIMBALL KINNISON, gray Lensman, had done everything that had *had* to be done before he blacked out. His final thought, feeble though it was, and incomplete, did its work.

Port Admiral Haynes was seated at his desk, discussing matters of import with an officeful of executives, when that thought arrived. Hardened old space hound that he was, and survivor of many encounters and hospitalizations, he knew instantly what that thought connoted and from the depths of what dire need it had been sent.

Therefore, to the amazement of the officers in the room, he suddenly leaped to his feet, seized his microphone and snapped out orders. Orders, and still more orders. Every vessel in seven sectors, of whatever class or tor age, was to shove its detectors out to the limit. Kinnison's speedster is out there somewhere. Find her—get her—kill her drive and drag her in here, to No. 10 landing field. Get a pilot here, fast—no, two pilots, in armor. Get them off the top of the board, too—Watson and Schermerhorn if they're anywhere within range. He then called Base Hospital.

"Lacy!" he barked at the dignified chief surgeon. "I've got a boy out that's badly hurt. He's coming in free. You know what that means. Send over a good doctor. And have you got a nurse who koows how to use a personal neutralizer and who isn't afraid to go into the net?"

"Coming myself. Yes." The doctor's voice was as crisp as the admiral's. "When do you want us?"

"As soon as they get their tractors on that speedster. You'll know when that happens."

Then, neglecting all other business, the port admiral directed in person tbe far-flung screen of ships searching for Kinnison's flying midget.

Eventually she was fouod; and Haynes, cutting off his plates, leaped to a closet in which was hanging his own armor. Unused for years, nevertheless it was kept in readiness for instant service; and now, at long last, the old space flea had a good excuse to use it again.

Armored, he strode out into the landing field across the paved way. There awaiting him were two armored figures, the two top-ranking pilots. There were the doctor and the nurse. He barely saw—or, rather, he saw without noticing—a saucy white cap atop a riot of red-bronze-auburn curls, a symmetrical young body in its spotless white. He did not notice the face at all. What he saw was that there was a neutralizer strapped snugly into the curve of her back, that it was fitted properly, and that it was not yet functioning.

FOR this that faced them was no ordinary job. The speedster would land free. Worse, the admiral feared—and rightly—that Kinnison would also be free, but independently, with a latent velocity different from that of his ship. They must enter the speedster, take her out into space and inert her. Kinnison must be taken out of the speedster, inerted, his velocity matched to that of the flier, and brought back aboard. Then and only then could doctor and nurse begin to work on him. Then they would have to land as fast as a landing could be made. The boy should have been in the hospital long ago.

And during all these evolutions and until their return to ground the rescuers themselves would remain inertialess. Ordinarily such visitors left the ship, inerted themselves, and came back to it inert, under their own power. But now there was no time for that. They had to get Kinnison to the hospital; and besides, the doctor and the nurse—particularly the nurse—could not be expected to be space-suit navigators. They would all take it in the net, and that was another reason for haste. For while they were gone their latent velocity would re-

main unchanged, while the actual velocity of their present surroundings would be changing constantly. The longer they were gone the greater would become the discrepancy. Hence the net.

The net—a leather-and-canvas sack, lined with softly padded inner-spring mattresses, anchored to ceiling and to walls and to floor through every shock-absorbing artifice of steel spring and of rubber cable that the mind of man had been able to devise. It takes something to absorb and to dissipate the kinetic energy which may reside within a human body when its latent velocity does not match exactly the actual velocity of its surroundings—that is, if that body is not to be mashed to a pulp. It takes something, also, to enable any human being to face without flinching the prospect of going into that net, especially in ignorance of exactly how much kinetic energy will have to be dissipated.

Haynes cogitated, studying the erect, supple young back, then spoke, "Maybe we'd better cancel the nurse, Lacy, or get her a suit——"

"Time is too important," the girl herself put in, crisply. "Don't worry about me, admiral; I've been in the net before."

She turned toward Haynes as she spoke, and for the first time he really saw her face. Why, she was a raving beauty—a knock-out—a seven-sector call-out——

"Here she is!" In the grip of a tractor the speedster had flashed to ground in front of the waiting five, and they hurried aboard.

They hurried, but there was no flurry, no confusion. Each knew exactly what to do, and each did it.

Out into space shot the little vessel, jerking savagely downward and sidewise as one of the pilots cut the Bergenholm. Out of the air lock flew the port admiral and the helpless, unconscious Kinnison, inertialess both and now chained together. Off they darted, in a new direction and with tremendous speed, as Haynes cut Kinnison's neutralizer. There was a mighty double flare as the drivers of both space suits struggled against that which had been the young Lensman's latent velocity.

As soon as it was safe to do so, out darted an armored figure with a space line, whose grappling end clinked into a socket of the old man's armor as the pilot rammed it home. Then, as an angler plays a fish, two husky pilots, feet wide-braced against the steel portal of the air lock and bodies sweating with effort, heaving when they could and giving line only when they must, helped the laboring drivers to overcome the difference in velocity.

SOON THE LENSMEN, young and old, were inside. Doctor and nurse went instantly to work, with the calmness and precision so characteristic of their highly skilled crafts. In a trice they had him out of his armor, out of his leather, and into a hammock, perceiving at once that except for a few pads of gauze they could do nothing for their patient until they had him upon an operating table. Meanwhile the pilots, having swung the hammocks, had been observing, computing, and conferring.

"She's got a lot of speed, admiral—most of it straight down," Watson reported. "On her landing jets it'll take two G's on a full revolution to bring her in. With both of us at the controls we can balance her down, but it'll have to be on her tail and it'll mean over five G's all the way. Which do you want?"

"Which is more important, Lacy, time or pressure?" Haynes transferred decision to the surgeon.

"Time." Lacy decided instantly. "Fight her down!" His patient had been through so much already of force and pressure that a little more would not do additional hurt, and time was most decidedly of the essence.

Starkly incandescent flares ripped and

raved from driving jets and side jets. The speedster spun around viciously, only to be curbed, skillfully if savagely, at the precisely right instant. Without an orbit, without even a corkscrew or other spiral, she was going down—straight down. And not upon her under jets was this descent to be, nor upon her more powerful braking jets. Those two master pilots, Prime Base's best, were going to kill the awful inertia of the speedster by "balancing her down on her tail." Or, to translate from the jargon of space, they were going to hold the tricky, cranky little vessel upright upon the terrific blasts of her driving projectors, against the Earth's gravitation and against all other perturbing forces, while her driving force counteracted, overcame, and dissipated the full frightful measure of the kinetic energy of her mass and speed!

And balance her down they did. Haynes was afraid for a while that that intrepid pair were actually going to *land* the speedster on her tail. They didn't—quite—but they had only a scant hundred feet to spare when they nosed her over and eased her to ground on her under jets.

The crash-wagon and its crew were waiting, and as Kinnison was rushed to the hospital the others hurried to the net room. Doctor Lacy first, of course, then the nurse; and, to Haynes' approving surprise, she took it like a veteran. Hardly had the surgeon let himself out of the "cocoon" than she was in it; and hardly had the terrific surges and recoils of her own not inconsiderable one hundred and forty-five pounds of mass abated than she herself was out and sprinting across the sward toward the hospital.

HAYNES went back to his office and tried to work, but he could not concentrate. He made his way back to the hospital. There he waited, and as Lacy came out of the operating room he buttonholed him.

"How about it, Lacy, will he live?" he demanded.

"Live? Of course he'll live," the surgeon replied, gruffly. "Can't tell you details yet—won't know, ourselves, for a couple of hours yet. Buzz off, Haynes. Come back at six o'clock—not a second before—and I'll tell you all about it."

Since there was no help for it the port admiral did "buzz off," but he was back promptly on the tick of the designated hour.

"How is he?" he began, without preamble. "Will he really live, or were you just giving me a shot in the arm?"

"Better than that, much better," the surgeon assured him. "Definitely so; yes. He is in much better shape than we dared hope. Must have been a very light crash indeed—nothing seriously the matter with him at all. We won't even have to amputate, from what we can see now. He should make a one-hundred-per-cent recovery, not only without artificial members, but with scarcely a scar. He couldn't have been in a space crack-up at all, or he would not have come out with so little injury."

"Fine, doc—wonderful! Now the details."

"Here's the picture." And the doctor unrolled a full-length X-ray print, showing every anatomical detail of the Lensman's interior structure. "First, just notice that skeleton. It is really remarkable. Slightly out of true here and there right now, of course, but I believe that it is going to turn out to be the second absolutely perfect male skeleton I have ever seen. That young man will go far, Haynes."

"Sure he will. Why else do you suppose we put him in gray? But I didn't come over here to be told that. Show me the damage."

"Look at the picture—see for yourself. Multiple and compound fractures, you notice, of legs and arm, and a few

ribs. Scapula, of course—there. Oh, yes, there's a skull fracture, too, but it doesn't amount to much. That's all. The spine, you see, isn't injured at all."

"What d'you mean, 'that's all'? How about his wounds? I saw some of them myself, and they were not pin pricks."

"Nothing of the least importance. A few punctured wounds and a couple of incised ones, but nothing even close to a vital part. He won't need even a transfusion, since he stopped the major hemorrhages himself, shortly after he was wounded. There are a few burns, of course, but they are mostly superficial—none that will not yield quite readily to treatment."

"Mighty glad of that. He'll be here six weeks then?"

"Better call it twelve, I think—ten at least. You see, some of the fractures, especially those in the left leg, and a couple of the burns, are rather severe, as such things go. Then, too, the length of time elapsing between injury and treatment didn't do anything a bit of good."

"In two weeks he'll be wanting to get up and go places and do things; and in six he'll be tearing down your hospital, stone by stone."

"Yes." The surgeon smiled. "He is not the type to make an ideal patient; but, as I have told you before, I like to have patients that we do not like."

"AND ANOTHER THING. I want the files on his nurses, particularly the red-headed one."

"I suspected that you would, so I had them sent down. Here you are. Glad you noticed MacDougall—she's by way of being my favorite. Clarrissa MacDougall—Scotch, of course, with that name—twenty years old. Height, one hundred sixty-eight centimeters; weight, sixty-six kilos. Here are her pictures. Never mind the conventional photo; this X-ray is the one that counts. Man, look at that skeleton! Beautiful! The only *really perfect* skeleton I ever saw in a woman——"

"It isn't the skeleton I'm interested in," grunted Haynes. "It's what is outside the skeleton that my Lensman will be looking at."

"You needn't worry about MacDougall," declared the surgeon. "One good look at that picture will tell you that. She classifies. With that skeleton she *has* to. She couldn't leave the beam a millimeter, even if she wanted to. Good, bad, or indifferent; male or female; physical, mental, moral, and psychological; the skeleton tells the whole story."

"Maybe it does to you, but not to me." And Haynes took up the "conventional" photograph—a stereoscope in full and absolutely true color, an almost living duplicate of the girl in question. Her thick, heavy hair was not red, but was a vividly intense and indescribable auburn, a gorgeous mass of coppery bronze, flashed with red and gold. Her eyes—bronze was all that he could think of, with flecks of topaz and of tawny gold. Her skin, too, was faintly bronze, glowing with even more than healthy youth's normal measure of sparkling vitality. Not only was she beautiful, the port admiral decided; in the words of the surgeon, she "classified."

"Hm-m-m. Worse even than I thought," he muttered. "She's a menace to civilization." And he went on to read the documents. "Family—hm-m-m. History. . . . Experiences. . . . Reactions and characteristics . . . behavior . . . psychology . . . mentality——"

"She'll do, Lacy," he advised the surgeon finally. "Keep her on with him."

"But see here, Haynes, you suspicious old granny!" snorted the doctor. "He won't be falling for anybody yet. Why, he's just been unattached. He'll be bulletproof for quite a while. You ought to know that young Lensmen—especially

young gray Lensmen—can't see anything but their jobs, for a couple of years, anyway."

"His skeleton tells you that, too, huh?" Haynes grunted, skeptically. "Ordinarily, yes! but you never can tell, especially in hospitals."

"More of your layman's misinformation!" Lacy snapped. "Contrary to popular belief, romance does not thrive in hospitals; except, of course, among the staff. Patients oftentimes think that they fall in love with nurses, but it takes two people to make one romance. Nurses do not fall in love with patients, because a man is never at his best under hospitalization. In fact, the better a man is, the poorer a showing he is apt to make."

"And, as I forget who said, a long time ago, 'no generalization is ever true, not even this one,'" retorted the port admiral. "When it does hit him it will hit hard, and we'll take no chances. How about the black-haired one?"

"Well, I just told you that MacDougall has the only perfect skeleton I ever saw in a woman. Brownlee is very good, too, of course, but——"

"But not good enough to rate Lensman's mate, eh?" Haynes completed the thought. "Then take her out. Pick the best skeletons you've got for this job, and see that no others come anywhere near him. Transfer them to some other hospital—to some other floor of this one, at least. Any woman that he ever falls for will fall for him, in spite of your ideas as to the one-wayness of hospital romance; and I don't want him to have such a good chance of making a dive at something that doesn't rate up. Am I right or wrong, you old sawbones, and for how much?"

"Well, I haven't had time yet to really study his skeleton, but——"

"Better take a week off and study it. I've studied a lot of people in the last sixty-five years, and I'll match my experience against your knowledge of bones, any time. Not saying that he *will* fall this trip, you understand—just playing safe. Good-by, Lacy!"

XVIII.

KINNISON was dragged out of unconsciousness by the knowledge that he had landed his speedster inertialess. He came to—or, rather, to say that he came half to would be a more accurate statement—with a yell directed at the blurrily seen figure in white which he knew must be a nurse.

"Nurse!" Then, as a searing stab of pain shot through him at the effort, he went on, thinking at the figure in white through his Lens: "My speedster! I landed her free! Get the space port ——"

"There, there, Lensman," a low, rich voice crooned, and a red head bent over him. "The speedster has been taken care of. Everything is on the needles; go to sleep and rest."

"But my ship——"

"Never mind your ship," the unctuous voice went on. "It was landed and put away——"

"Listen, dumb-bell!" snapped the patient, speaking aloud now, in spite of the pain, the better to drive home his meaning. "Don't try to soothe me! What do you think I am, delirious? Get this and get it straight. I said that I landed that speedster *free*. If you don't know what that means, tell somebody that does. Get the space port—get Haynes—get——"

"We got them, Lensman, long ago." Although her voice was still creamily, sweetly soft, an angry color burned into the nurse's face. "I said everything is on zero. Your speedster was inerted; how else could you be here, inert? I helped do it myself, so I *know* that she is inert."

"QX." The patient relapsed instantly into unconsciousness and the nurse turned to an interne standing by.

(Wherever *that* nurse was, at least one doctor could almost always be found.)

"Dumb-bell!" she flared. "What a sweet mess *he's* going to be to take care of! He's not even conscious yet, and he's calling names and picking fights already!"

In a few days Kinnison was fully and alertly conscious. In a week most of the pain had left him, and he was beginning to chafe under restraint. In ten days he was "fit to be tied," and his acquaintance with his head nurse, so inauspiciously begun, developed even more inauspiciously as time went on. For, as Haynes and Lacy had each more than anticipated, the Lensman was by no means an ideal patient. In fact, he was most decidedly the opposite.

Nothing that could be done would satisfy him. All doctors were fatheads, even Lacy, the man who had put him together. All nurses were dumb-bells, even—or specially?—Mac, who with almost superhuman skill, tact and patience had been holding him together. Why, even fatheads and dumb-bells, even high-grade morons, ought to know that a man needed food!

Accustomed to eating everything that he could reach, three or four or five times a day, he did not realize—nor did his stomach—that his now quiescent body could no longer use the five thousand or more calories that it had been wont to burn up, each twenty-four hours, in intense effort. He was always hungry, and he was forever demanding food.

And food, to him, did not mean orange juice or grape juice or tomato juice or milk. Nor did it mean weak tea and hard, dry toast and an occasional soft-boiled egg. If he ate eggs at all he wanted them fried—three or four of them, accompanied by two or three thick slices of ham.

He wanted—and demanded in no uncertain terms, argumentatively and persistently—a big, thick, rare beefsteak. He wanted baked beans, with plenty of fat pork. He wanted bread in thick slices, piled high with butter, and not this quadruply-and-unmentionably-qualified toast. He wanted roast beef, rare, in great chunks. He wanted potatoes and thick brown gravy. He wanted corned beef and cabbage. He wanted pie—any kind of pie—in large, thick quarters. He wanted peas and corn and asparagus and cucumbers, and also various other worldly staples of diet which he often and insistently mentioned by name.

But above all, he wanted beefsteak. He thought about it days and dreamed about it nights. One night in particular he dreamed about it—an especially luscious porterhouse, fried in butter and smothered in mushrooms—only to wake up, mouth watering, literally starved, to face again the weak tea, dry toast, and, horror of horrors, this time a flabby, pallid, flaccid *poached* egg! It was the last straw.

"Take it away," he said, weakly; then, when the nurse did not obey, he reached out and pushed the breakfast, tray and all, off the table. As it crashed to the floor, he turned away, and, in spite of all his efforts, two hot tears forced themselves between his eyelids.

IT WAS a particularly trying ordeal, and one requiring all of even Mac's skill, diplomacy, and forbearance, to make the recalcitrant patient eat the breakfast prescribed for him. She was finally successful, however, and as she stepped out into the corridor she met the ubiquitous interne.

"How's your Lensman?" he asked, in the privacy of the diet kitchen.

"Don't call him *my* Lensman!" she stormed. She was about to explode with the pent-up feelings which she, of course, could not vent upon such a pitiful, helpless thing as her star patient. "Beefsteak! I almost wish they *would* give him a beefsteak, and that he'd choke on it—which, of course, he would. He's

worse than a baby. I never saw such a —such a *brat* in my life. I'd like to spank him! He needs it. I'd like to know how *he* ever got to be a Lensman, the big, cantankerous clunker! I'm *going* to spank him, too, one of these days; see if I don't!"

"Don't take it so hard, Mac," the interne urged. He was, however, very much relieved that relations between the handsome young Lensman and the gorgeous redhead were not upon a more cordial basis. "He won't be here very long. But I never saw a patient clog *your* jets before."

"You probably never saw a patient like *him* before, either. I certainly hope he never gets cracked up again."

"Huh?"

"Do I have to draw you a chart?" she asked, sweetly. "Or, if he does get cracked up again, I hope they send him to some other hospital." And she flounced out.

Nurse MacDougall thought that when the Lensman could eat the meat he craved, her troubles would be over; but she was mistaken. Kinnison was nervous, moody, brooding, by turns irritable, sullen, and pugnacious. Nor is it to be wondered at. He was chained to that bed, and in his mind was the gnawing consciousness that he had failed. And not only failed—he had made a complete fool of himself. He had underestimated an enemy, and as a result of his own stupidity the whole patrol had taken a setback. He was anguished and tormented.

Therefore: "Listen, Mac," he pleaded on day. "Bring me some clothes and let me take a walk. I need the exercise."

"Not yet, Kim," she denied him gently, but with her entrancing smile in full evidence. "But pretty quick, when that leg looks a little less like a Chinese puzzle, you and nursie go bye-bye."

"Beautiful, but dumb!" the Lensman growled. "Can't you and those cock-eyed croakers realize that I'll *never* get any strength back if you keep me in bed all the rest of my life? And don't talk baby talk at me, either. I'm well enough at least so that you can wipe that professional smile off your pan and cut that soothing bedside manner of yours."

"Very well—I think so, too!" she snapped, patience at long last gone. "Somebody should tell you the truth. I always supposed that Lensmen had to have *brains*, but you've acted like a spoiled brat ever since you've been here. First you wanted to eat yourself sick, and now you want to get up, with bones half knit and burns half healed, and undo everything that has been done for you. Why don't you snap out of it and act your age for a change?"

"I never did think nurses had much sense, and now I know they haven't." Kinnison eyed her with intense disfavor, not at all convinced. "I'm not talking about going back to work. I mean a little gentle exercise, and I know what I need."

"You'd be surprised at what you don't know." And the nurse walked out, chin in air. In five minutes, however, she was back, her radiant smile again flashing.

"Sorry, Kim, I shouldn't have blasted off that way. I know that you're bound to back-fire and to have brain storms. I would, too, if I were——"

"Cancel it, Mac," he began, awkwardly. "I don't know why I have to be such a mutt as to be crabbing at you all the time."

"QX, Lensman," she replied, entirely serene now. "I do. You are not the type to stay in bed without it griping you; but when a man has been ground up into such hamburger as you are, he has to stay in bed whether he likes it or not, and no matter how much he pops off about it. Roll over here, now, and I'll give you an alcohol rub. But it won't be long now, really—pretty soon we'll have you out in a wheel chair——"

Thus it went for weeks. Kinnison knew his behavior was atrocious, abominable; but he simply could not help it. Every so often the accumulated pressure of his bitterness and anxiety *would* blow off; and, like a jungle tiger with a toothache, he would bite and claw anything or anybody within reach.

FINALLY, however, the last picture was studied, the last bandage was removed, and he was discharged as fit. And he was not discharged, bitterly although he resented his "captivity," as he called it, until he really *was* fit. Haynes saw to that. And Haynes had allowed only the most sketchy interviews during that long convalescence. Discharged, however, Kinnison sought him out.

"Let me talk first," Haynes instructed him at sight. "No self-reproaches, no destructive criticism. Everything constructive. Now, Kimball, I'm mighty glad to hear that you made a perfect recovery. You were in bad shape. Go ahead."

"You have just about shut my mouth by your first order." Kinnison smiled sourly as he spoke. "Two words—flat failure. No, let me add two more—as yet."

"That's the spirit!" Haynes exclaimed. "Nor do we agree with you that it was a failure. It was merely not a success—so far—which is an altogether different thing. Also, I may add that we had very fine reports indeed on you from the hospital."

"Huh?" Kinnison was amazed to the point of being inarticulate.

"You just about tore it down, of course, but that was only to be expected."

"But, sir, I made such a——"

"Exactly. As Lacy tells me quite frequently, he likes to have patients over there that they don't like. Mull that one over for a bit. You may understand it better as you get older. The thought, however, may take some of the load off your mind."

"Well, sir, I am feeling a trifle low, but if you and the rest of them still think ——"

"We do so think. Cheer up and get on with the story."

"I've been doing a lot of thinking, and before I go around sticking out my neck again I'm going to——"

"You don't need to tell me, you know."

"No, sir, but I think I'd better. I'm going to Arisia to see if I can get me a few treatments for swelled head and lame brain. I still think that I know how to use the Lens to good advantage, but I simply haven't got enough jets to do it. You see, I——" He stopped. He would not offer anything that might sound like an alibi; but his thoughts were plain as print to the old Lensman.

"Go ahead, son. We know you wouldn't."

"If I thought at all, I assumed that I was tackling men, since those on the ship were men, and men were the only known inhabitants of the Aldebaranian system. But when those Wheelmen took me so easily and so completely, it became very evident that I didn't have enough stuff. I ran like a scared pup, and I was lucky to get home at all. It wouldn't have happened if——" He paused.

"If what? Reason it out, son," Haynes advised, pointedly. "You are wrong, dead wrong. You made no mistake, either in judgment or in execution. You have been blaming yourself for assuming that they were men. Let us suppose that you had assumed that they were the Arisians themselves. Then what? After close scrutiny, even in the light of after-knowledge, we do not see how you could have changed the outcome." It did not occur, even to the sagacious old admiral, that Kinnison need not have gone in. Lensmen always went in.

"Well, anyway, they licked me, and that hurts," Kinnison admitted, frankly.

"So I'm going back to Arisia for more training, if they'll give it to me. I may be gone quite a while, as it may take even them a long time to increase the permeability of my skull enough so that an idea can filter through it in something under a century."

"Um-m-m." Haynes pondered. "It has never been done. They are a peculiar race, incomprehensible—but not vindictive. They may refuse you, but nothing worse—that is, if you do not cross the barrier without invitation. It's a splendid idea, I think; but be very careful to strike that barrier free and at almost zero power—or else don't strike it at all."

THEY SHOOK HANDS, and in a space of minutes the speedster was again tearing through space. Kinnison now knew exactly what he wanted to get, and he utilized every waking hour of that long trip in physical and mental exercise to prepare himself to take it. Thus the time did not seem long. He crept up to the barrier at a snail's pace, stopping instantly as he touched it, and through that barrier he sent a thought.

"Is it permitted that I approach your planet?" he asked, neither brazenly nor obsequiously. He was matter-of-factly asking a simple question and expecting a simple reply. He knew that to these beings, whatever they really were, salutations and identifications were alike superfluous. Nor was he met as Helmuth had been met.

"Ah, 'tis Kimball Kinnison, of Earth," a slow, deep, measured voice resounded in his brain. "Neutralize your controls. You will be landed."

He did so, and the inert speedster shot forward, to come to ground in a perfect landing at a regulation space port. He strode into the office, to confront the same grotesque, dragonlike entity who had measured him for his Lens not so long ago. Now, however, he stared straight into that entity's unblinking eyes, in silence.

"Ah, you have progressed. You realize now that vision is not always reliable. At our previous interview you took it for granted that what you saw must really exist, and did not wonder as to what our true shapes might be."

"I am wondering now, seriously," Kinnison replied. "And if it is permitted, I intend to stay here until I can see your true shapes."

"This?" And the figure changed instantly into that of an old, white-bearded, scholarly gentleman.

"No. There is a vast difference between seeing something myself and having you show it to me. I realize only too well that you can make me see you as anything you choose. You could appear to me as a perfect copy of myself, or as any other thing, person or object conceivable to my mind."

"Ah, you have indeed progressed. While you were expected to return, you are ahead of time by several of your years. When you approached the barrier it was supposed that you came to ask for some particular information, but now that I search your mind I perceive that what you seek is not mere information, but is indeed knowledge."

"You say that you expected me. How could you know that I was coming? I didn't decide definitely myself until only a couple of weeks ago."

"It was inevitable. When we fitted your Lens we knew that you would return if you lived. As we recently informed that one known as Helmuth ——"

"Helmuth! You know, then, where ——" Kinnison choked himself off. He would not ask for help in that. He would fight his own battles and bury his own dead. If they volunteered the nformation, well and good; but he would not ask it. Nor did the Arisian furnish it.

"You are right," the sage remarked,

imperturbably. "For strong development it is essential that you secure that information for yourself."

Then he continued his previous thought: "As we told Helmuth recently, we have given your civilization an instrumentality—the Lens—by virtue of which it should be able to make itself secure throughout the galaxy. Having given it, we could do nothing more of real or permanent benefit until you Lensmen yourselves began to realize what it was that we had given you. That realization has been inevitable; from the first it has been certain that in time your minds would become strong enough to discover the theretofore unknown depths of power of your Lenses. As soon as any mind made that discovery it would, of course, return to Arisia, the source of the Lens, for additional instruction; which, equally of course, that mind could not have borne previously.

"Decade by decade your minds have become stronger. Finally you came to be fitted with a Lens. Your mind, while pitifully undeveloped, had a latent capacity and a power that made your return here certain. Since your enlensment there has been one other who will return. Indeed, it has become a topic of discussion among us as to whether you or that other would be the first advanced student."

"Who is that other, if I may ask?"

"Your friend, Worsel, the Velantian."

"He's got a real mind—'way, 'way ahead of mine," the Lensman stated, as a matter of self-evident fact.

"In some ways, yes. In other and highly important characteristics, no."

"Huh?" Kinnison exclaimed. "In what possible way have I got it over him?"

"I am not certain that I can explain it exactly in thoughts which you can understand. Broadly speaking, his mind is the better trained, the more fully developed. It is of more grasp and reach, and of vastly greater present power. It is more controllable, more responsive, more adaptable than is yours—now. But your mind, while undeveloped, is of considerably greater capacity than his, and of greater and more varied latent capabilities. Above all, you have a driving force, a will to do, an undefeatable mental urge that no one of his race will be able to develop for many cycles of time to come. Since I selected you as the first to return, I am naturally gratified that you have developed so rapidly."

"Well, I have been more or less under pressure, and I got quite a few lucky breaks. But at that, it seemed to me that I was progressing backward instead of forward."

"It is ever thus with the really competent. Prepare yourself!"

He launched a mental bolt, at the impact of which Kinnison's mind literally turned inside out in a wildly gyrating spiral vortex of dizzyingly confused images.

"Resist!" came the harsh command.

"Resist! How?" demanded the writhing, sweating Lensman. "You might as well tell a fly to resist an inert space ship!"

"Use your will—your force—your adaptability. Shift your mind to meet mine at every point. Apart from these fundamentals neither I nor any one else can tell you how; each mind must find its own medium and develop its own technique. But this is a very mild treatment indeed, one conditioned to your present strength. I will increase it gradually in severity, but rest assured that I will at no time raise it to the point of permanent damage. Constructive exercises will come later; the first step must be to build up your resistance. Therefore, resist!"

The force, which had not slackened for an instant, waxed slowly to the very verge of intolerability; and grimly, doggedly, the Lensman fought it. Teeth locked, muscles straining, fingers digging savagely into the hard leather up-

holstery of his chair he fought it; mustering his every ultimate resource to the task——

Suddenly, the torture ceased and the Lensman slumped down, a mental and physical wreck. He was white, trembling, sweating, shaken to the very core of his being. He was ashamed of his weakness. He was humiliated and bitterly disappointed at the showing he had made; but from the Arisian there came a calm, encouraging thought.

"You need not feel ashamed; you should instead feel proud, for you have made a start which is really surprising, even to me, your sponsor. This may seem to you like needless punishment, but it is not. This is the only possible way in which that which you seek may be found."

"In that case, go to it," the Lensman declared. "I can take it."

DAY AFTER DAY and week after week the "advanced instruction" went on, with the pupil becoming ever stronger, until he was taking without damage thrusts that would have slain him instantly a few weeks since. The bouts became shorter and shorter, requiring as they did such terrific outpourings of mental force that not even the master could stand the awful strain for more than half an hour at a time.

And now these savage conflicts of wills and minds were interspersed with real instruction, with lessons neither painful nor unpleasant. In these the aged scientist probed gently into the youngster's mind, opening it and exposing to its owner's gaze vast caverns whose very presence he had never even suspected. Some of these storehouses were already partially or completely filled, needing only arrangement and connection. Others were nearly empty. These were catalogued and made accessible. And in all, permeating everything, was the Lens.

"Just like clearing out a clogged-up water system; with the Lens the pump that wouldn't work!" exclaimed Kinnison one day.

"More like that than you at present realize," assented the Arisian. "You have observed, of course, that I have not given you any detailed instructions nor pointed out any specific ablilities of the Lens which you have not known how to use. You will have to operate the pump yourself; and you have many surprises awaiting you as to what your Lens will pump, and how. Our sole task is to prepare your mind to work with the Lens, and that task is not yet done. Let us on with it."

Eventually the time came when Kinnison could block out entirely the suggestions of his mentor, but he did not reveal that fact; nor, now blocked out, could the Arisian discern it. The Lensman gathered all his force together, concentrated it, and hurled it back at his teacher; and there ensued a struggle none the less Titanic because of its essential friendliness. The very ether seethed and boiled with the fury of the mental forces there at grips, but finally the Lensman beat down the other's screens. Then, boring deep into his eyes, he willed with all his force to see that Arisian as he really was. And instantly the scholarly old man subsided into a—a *brain!* There were a few appendages, of course, and other appurtenances and incidentials to nourishment, locomotion, and the like, but to all intents and purposes the Arisian was simply and solely a brain.

Tension ended; conflict ceased; and Kinnison apologized.

"Think nothing of it." And the brain actually smiled into Kinnison's mind. "Any mind of power sufficient to block mine is, of course, able to hurl no feeble bolts of its own. See to it, however, that you thrust no such force at any lesser mind, or it dies instantly."

Kinnison started to stammer a reply, but the Arisian went on: "No, son, I

knew and know that the warning is superfluous. If you were not worthy of this power and were you not able to control it properly you would not have it. You have obtained that which you sought. Go, then, with power."

"But this is only one phase, barely a beginning!" protested Kinnison.

"Ah, you realize even that? Truly, youth, you have come far and fast. But you are not yet ready for more, and it is a truism that the reception of forces for which a mind is not prepared will destroy that mind. Thus, when you came to me you knew exactly what you wanted. Do you know with equal certainty what more you want from us?"

"No."

"Nor will you for years, if ever. Indeed, it may well be that only your descendants will be ready for that for which you now so dimly grope. Again I say, young man, go with power."

Kinnison went.

XIX.

IT HAD TAKEN the Lensman a long time to work out in his mind exactly what it was that he had wanted from the Arisians, and from no single source had the basic idea come. Part of it had come from his own knowledge of ordinary hypnosis; part from the ability of the Overlords of Delgon to control from a distance the minds of others; part from Worsel, who, working through Kinnison's own mind, had done such surprising things with a Lens; and a great part indeed from the Arisians themselves, who had the astounding ability literally and completely to superimpose their own mentalities upon those of others, wherever situate. Part by part and bit by bit the Tellurian Lensman had built up his plan, but he had not had the sheer power of intellect to make it work. Now he had that, and was ready to go.

Where? His first impulse was to return to Aldebaran I and to invade again the stronghold of the Wheelmen, who had routed him so ignominiously in his one encounter with them. Ordinary prudence, however, counseled against that course.

"You'd better lay off them a while, Kim old boy," he told himself quite frankly. "They've got a lot of jets and you don't know how to use this new stuff of yours yet. Better pick out something easier to take!"

Ever since leaving Arisia he had been subconsciously aware of a difference in his eyesight. He was seeing things much more clearly than he had ever seen them before, more sharply and in greater detail. Now this awareness crept into his consciousness and he glanced toward his tube lights. They were out—except for the tiny lamps and bull's-eyes of his instrument board the vessel must be in complete darkness. He remembered then, with a shock, that when he entered the speedster he had not turned on his lights. He could see, and had not thought of them at all!

This, then, was the first of the surprises the Arisian had promised him. He now had the sense of perception of the Rigellians. Or was it that of the Wheelmen? Or both? Or were they the same sense? Intently aware now, he focused his attention upon a meter before him. First upon its dial, noting that the needle was exactly upon the green hair line of normal operation. Then deeper. Instantly, the face of the instrument disappeared—moved behind his point of sight, or so it seemed—so that he could see its coils, pivots, and other interior parts. He could look into and study the grain and particle size of the dense, hard condensite of the board itself. His vision was limited, apparently, only by his will to see!

"Well—ain't—that—something!" he demanded of the universe at large; then, as a thought struck him: "I wonder if they blinded me in the process?"

He switched on his lamps, discovering that his vision was unimpaired and normal in every respect; and a rigid investigation proved to him conclusively that in addition to ordinary vision he now had an extra sense—or perhaps two of them—and that he could change from one to the other, or use them simultaneously, at will! But the very fact of this discovery made Kinnison pause.

He hadn't better go anywhere, or do anything, until he had found out something about his new equipment. The fact was that he didn't even know what he had, to say nothing of knowing how to use it. If he had the sense of a hoot owl he would go somewhere where he could do a little experimenting without getting his jets burned off in case something slipped at a critical moment. Where was the nearest patrol base—a big one, fully defended? Let's see—Radelix would be about the closest Sector Base, he guessed. He'd find out if he could raid that outfit without getting caught at it.

Off he shot, and in due course a fair, green, Earthlike planet lay beneath his vessel's keel. Since it was Earthlike in climate, age, atmosphere, and mass, its people were, of course, more or less similar to humanity in general characteristics, both of body and of mind. If anything, they were even more intelligent than Earthlings, and their patrol base was a very strong one indeed. His spy ray would be useless, since all patrol bases were screened thoroughly and continuously. He would see what a sense of perception would do. From Tregonsee's explanation, it ought to work at this range.

IT DID. When Kinnison concentrated his attention upon the base he saw it. He advanced toward it at the speed of thought and entered it; passing through screens and metal walls without hindrance and without giving alarm. He saw men at their accustomed tasks and heard, or rather sensed, their conversation: the everyday chat of their professions. A thrill shot through him at a dazzling possibility thus revealed.

If he could make one of those fellows down there do something without his knowing that he was doing it, the problem was solved. That computer, say; make him uncover that calculator and set up a certain integral on it. It would be easy enough to get into touch with him and have him do it, but this was something altogether different.

Kinnison got into the computer's mind easily enough, and willed intensely what he was to do; but the officer did not do it. He got up; then, staring about him in bewilderment, sat down again.

"What's the matter?" asked one of his fellows. "Forget something?"

"Not exactly." The computer still stared. "I was going to set up an integral. I didn't want it, either. I could swear that somebody *told* me to set it up."

"Nobody did," grunted the other, "and you'd better start staying home nights. Then maybe you wouldn't get funny ideas."

This wasn't so good, Kinnison reflected. The guy should have done it and shouldn't have remembered a thing about it. Well, he hadn't really thought he could put it across at that distance, anyway. He didn't have the brain of an Arisian. He'd have to follow his original plan, of close-up work.

Waiting until the base was well into the night side of the planet and making sure that his flare baffles were in place, he allowed the speedster to drop downward, landing at some little distance from the fortress. There he left the ship and made his way toward his objective in a rapid series of long, inertialess hops. Lower and shorter became the hops. Then he cut off his power entirely and walked until he saw before him, rising from the ground and

stretching interminably upward, an almost invisibly shimmering web of force. This, the prowler knew, was the curtain which marked the border of the reservation, the trigger upon which a touch, either of solid object or of beam, would liberate a veritable inferno of the most destructive agencies generable.

To the eye that base was not impressive, being merely a few square miles of level ground, outlined with low, broad pill boxes and studded here and there with harmless-looking, bulging domes. There were a few clusters of buildings. That was all—to the eye—but Kinnison was not deceived. He knew that the base itself was a thousand feet underground; that the pill boxes housed lookouts and detectors; and that those domes were simply weather shields which, rolled back, would expose projectors second in power not even to those of Prime Base itself.

Far to the right, between two tall pylons of metal, was the gate, the only opening in the web. Kinnison had avoided it purposely; it was no part of his plan to subject himself yet to the scrutiny of the all-inclusive photo cells of that entrance. Instead, with his new sense of perception, he sought out the conduits leading to those cells and traced them down, through concrete and steel and masonry, to the control room far below.

He then superimposed his mind upon that of the man at the board and flew boldly toward the entrance. He now actually had a dual personality; since one part of his mind was in his body, darting through the air toward the portal, while the other part was deep in the base below, watching him come and acknowledging his signals!

A TRAP LIFTED, revealing a sloping, tunneled ramp, down which the Lensman shot. He soon found a convenient storeroom. Slipping within it, he withdrew his control carefully from the mind of the observer, wiping out all traces of that control as he did so. He then watched apprehensively for a possible reaction. He was almost sure that he had performed the operation correctly, but he had to be absolutely certain; more than his life depended upon the outcome of this test. The observer, however, remained calm and placid at his post; and a close reading of his thoughts showed that he had not the faintest suspicion that anything untoward had occurred.

One more test and he was through. He must find out how many minds he could control simultaneously, but he'd better do that openly. No use making a man feel like a fool needlessly. He'd done that once already, and once was too many times.

Therefore, reversing the procedure by which he had come, he went back to his speedster, took her out into the ether, and slept. Then, when the light of morning flooded the base, he cut his detector nullifier and approached it boldly.

"Radelix base! Lensman Kinnison of Tellus asking permission to land. I wish to confer with your Lensman. My screens are down."

A spy ray swept through the speedster, the web disappeared, and Kinnison landed, to be greeted by four fellow Lensmen with a quiet and cordial respect—cordiality for his Lens and respect for his gray. The base commander knew that his visitor was not there purely for pleasure. Gray Lensmen did not take pleasure jaunts. Therefore, he led the way into his private office and shielded it.

"My announcement was not at all informative," Kinnison admitted then, "but my errand is nothing to be advertised. I've got to try out something, and I want to ask you four Lensmen to cooperate with me for a few minutes."

"You need not ask——" began the commander.

"No, this is not an order at all, simply a request. You see, I've been working a long time on a mind controller, and I want to see if it works. I'll put four books on this table, one in front of each of you. Now I would like to try to make two or three of you—all four of you if I can—each bend over, pick up his book, and hold it. Your part of the game will be for each of you to try not to pick it up, and to put it back as soon as you possibly can if I do make you obey. Will you?"

"Sure!" the three of them chorused.

"There will be no mental damage, of course?" asked the commander.

"None whatever, and no after effects. I've had it worked on myself, a lot."

"Do you want any apparatus?"

"No, I have everything necessary. Remember, I want top resistance."

"Let her come! You'll get plenty of resistance. If you can make any one of us pick up a book, after all this warning, I'll say you've got something."

LENSMAN after Lensman, in spite of strainingly resisting mind and body, lifted his book from the table, only to drop it again as Kinnison's control relaxed for an instant. He could control two of them—*any* two of them—but he could not quite handle three. Satisfied, he ceased his efforts.

As the base commander poured long, cold drinks for the sweating five, one of his fellows asked: "What did you do, anyway, Kinnison? Oh, pardon me, I shouldn't have asked."

"Sorry," the Tellurian replied uncomfortably, "but it isn't ready yet. You'll all know about it as soon as possible, but not just now."

"Sure," the Radeligian replied. "I knew I shouldn't have blasted off as soon as I spoke."

"Well, thanks a lot, fellows." Kinnison set his empty glass down with a click. "I can make a nice progress report on this dojig now. And one more thing. I did a little long-range experimenting on one of your computers last night."

"Desk 12? The one who thought he wanted to integrate something?"

"That's the one. Tell him I was using him for a mind-ray subject, will you, and give him this fifty-credit bill? Don't want the boys needling him *too* much."

"Yes, and thanks. And—I wonder ——" The base commander evidently had something on his mind. "Say, can you make a man tell the truth with that? And if you can, will you?"

"I think so. Certainly I will, if I can. Why?" Kinnison knew that he could do so, but he did not wish to seem cocksure.

"There's been a murder." The other three glanced at each other in understanding and sighed with profound relief. "A particularly fiendish murder of a woman—girl, rather. Two men have been accused. Each has a perfect alibi, supported by honest witnesses; but you know how much an alibi means now. Both men tell perfectly straight stories under the Lens and all other lie detectors. Either one of those men is lying with a polish I would never have believed possible, or both are innocent. And one of them *must* be guilty; these are the only suspects. If we try them now we make fools of ourselves; and we can't put off the trial very much longer without losing face. If you can help us out you'll be doing a lot for the patrol throughout this whole sector."

"I can help you," Kinnison declared. "For this, though, better have some props. Make me a box—double Burbank controls, with five baby spots on it—orange, blue, green, purple and red. I want the biggest set of head phones you've got, and a thick, black blindfold. How soon can you try 'em?"

"The sooner the better. It can be arranged for this afternoon."

THE TRIAL was announced, and long before the appointed hour the great courtroom of that world's largest city was thronged. The hour struck. Quiet reigned. Kinnison, the Lensman, in somber gray, strode to the judge's desk and sat down behind the peculiar box upon it. In dead silence two other Lensmen approached. The first invested him reverently with the head phones; the second so enwrapped his head in black cloth that it was apparent to all observers that his vision was completely obscured.

"Although from a world far distant in space, I have been asked to try two suspects for the crime of murder," Kinnison intoned. "I do not know the details of the crime nor the identity of the suspects. I do know that they and their witnesses are within these railings. I shall now select those who are about to be examined."

Piercing beams of intense, varicolored light played over the two groups, and the deep, impressive voice went on: "I know now who the suspects are. They are about to rise, to walk, and to seat themselves as I shall direct."

They did so, it being plainly evident to all observers that they were under some awful compulsion.

"The witnesses may be excused. Truth is the only thing of importance here; and witnesses, being human and therefore frail, obstruct truth more frequently than they further its progress. I shall now examine these two accused."

Again the vivid, weirdly distorting glares of light lashed out, bathing in intense monochrome and in various ghastly combinations first one prisoner, then the other; the while Kinnison drove his mind into theirs, plumbing their deepest depths. The silence, already profound, became the utter stillness of outer space as the throng, holding its very breath now, sat enthralled by that portentous examination.

"I have examined them fully. You are all aware that any Lensman of the Galactic Patrol may, in case of need, serve as judge, jury, and executioner. I am, however, none of these; nor is this proceeding to be a trial as you may have understood the term. I have said that witnesses are superfluous. I will now add that neither judge nor jury is necessary. All that is required is to discover the truth, since truth is all-powerful. For that reason, also, not even an executioner is needed here—the discovered truth will in and of itself serve us in that capacity.

"One of these men is guilty; the other is innocent. From the mind of the guilty one I am about to construct a composite, not of this one fiendish crime alone, but of all the crimes he has ever committed. I shall project that composite into the air before him. No innocent mind will be able to see any iota of it. The guilty man, however, will perceive its every revolting detail; and, so perceiving, he will forthwith cease to exist in this plane of life."

One of the men had nothing to fear—Kinnison had told him so, long since. The other had been trembling for minutes in uncontrollable paroxysms of terror. Now this one leaped from his seat, clawing savagely at his eyes and screaming in mad abandon.

"I did it! Help! Mercy! Take her away! Oh-h-h——" he shrieked, and died, horribly, even as he shrieked.

Nor was there noise in the courtroom after the thing was over. The stunned spectators slunk away, scarcely daring even to breathe until they were safely outside.

NOR were the Radeligian Lensmen much more at ease. Not a word was said until the five were back in the commander's office at base. Then Kinnison, still white of face and set of jaw, spoke. The others knew that he had found the guilty man, and that he had in some pe-

culiarly terrible fashion executed him. He knew that they knew that the man was hideously guilty.

Nevertheless, the Tellurian said, "He was guilty—guilty as all the devils in all the hells of the entire universe. I never had to do that before, and it gripes me—but I couldn't shove the job off onto you fellows. I wouldn't want anybody to see that picture who didn't have to, and without it you could never begin to understand just how atrociously and damnably guilty that hell hound really was."

"Thanks, Kinnison," the commander said, simply. "Kinnison. Kinnison of Tellus. I'll remember that name, in case we ever need you as badly again. But, after what you just did, it will be a long time—if ever. You didn't know, did you, that all the inhabitants of four planets were watching you?"

"Holy rockets, no! Were they?"

"They were. And if the way you scared *me* is any criterion, it will be a long, cold day before anything like that comes up again in this system. And thanks again, gray Lensman. You have done something for our whole patrol this day."

"Be sure to dismantle that box so thoroughly that nobody will recognize any of its component parts." Kinnison managed a rather feeble grin. "One more thing and I'll buzz along. Do you fellows happen to know where there's a good, strong pirate base around here anywhere? And, while I don't want to seem fussy, I would like it all the better if they were warm-blooded oxygen breathers, so that I won't have to wear armor all the time."

"What are you trying to do, give us the needle, or something?" This is not precisely what the Radeligian said, but it conveys the thought Kinnison received as the base commander stared at him in amazement.

"Don't tell me that there *is* such a base around here!" exclaimed the Tellurian in delight. "Is there, really?"

"There is. It is so strong that we have not been able to touch it, and it is manned and staffed by natives of your own planet, Tellus of Sol. We reported it to Prime Base some eighty-three days ago, just after we discovered it. You're direct from there——" He fell silent. This was no way to be talking to a gray Lensman.

"I was in the hospital then, fighting with my nurse because she wouldn't give me anything to eat," Kinnison explained with a laugh. "When I left Tellus I didn't check up on the late data—didn't think I would need it quite so soon. If you've got it, though——"

"Hospital! You?" queried one of the younger Lensmen.

"Yeah—bit off more than I could chew." And the Tellurian briefly described his misadventure with the Wheelmen of Aldebaran I. "This other thing has come up since then, though, and I won't be sticking my neck out that way again. If you've got such a made-to-order base as that in this region, it'll save me a long trip. Where is it?"

They gave him its coördinates and what little information they had been able to secure concerning it. They did not ask him why he wanted that data. They may have wondered at his temerity in daring to scout alone a fortress whose strength had kept at bay the massed patrol forces of the sector; but if they did so they kept their thoughts well screened. For this was a gray Lensman, and very evidently a super-powered individual, even of that select group whose weakest members were powerful indeed. If he felt like talking they would listen; but Kinnison did not talk. He did the listening.

Then, when he had learned everything they knew of the Boskonian base, he said, "Well, I'd better be buzzing. Clear ether, fellows!" And he was gone.

XX.

OUT from Radelix and into deep space shot the speedster, bearing the gray Lensman toward Boyssia II, where the Boskonian base was situated. The patrol forces had not even yet been able to locate it definitely; therefore, it must be cleverly hidden indeed. It was manned and staffed by Tellurians—and this was fairly close to the line first taken by the pilot of the pirate vessel whose crew had been so decimated by VanBuskirk and his Valerians. There couldn't be so many Boskonian bases with Tellurian personnel, Kinnison reflected. It was well within the bounds of possibility, even of probability, that he might again encounter here his former, but unsuspecting, shipmates.

Since the Boyssian system was less than a hundred parsecs from Radelix, a couple of hours found the Lensman staring down upon another green and Earthly world. Very Earthly indeed was this one. There were polar ice caps, areas of intensely dazzling white. There was an atmosphere, deep and sweetly blue, filled for the most part with Sunlight, but flecked here and there with clouds, some of which were slow-moving storms. There were continents, bearing mountains and plains, lakes and rivers. There were oceans, studded with islands great and small.

But Kinnison was no planetographer, nor had he been gone from Tellus sufficiently long so that the sight of this beautiful and homelike world aroused in him any qualm of nostalgia. He was looking for a pirate base; and, dropping his speedster as low into the night side as he dared, he began his search.

Of man or of the works of man he at first found little enough trace. All human or pseudohuman life was apparently still in a savage state of development; and, except for a few scattered races, or rather tribes, of burrowers and of cliff or cave dwellers, it was still nomadic, wandering here and there without permanent habitation or structure. Animals of scores of genera and species were there in myriads, but neither was Kinnison a biologist. He wanted pirates; and, it seemed, that was the one form of life which he was *not* going to find!

But finally, through sheer, grim, bulldog pertinacity, he was successful. That base was there, somewhere. He would find it, no matter how long it took. He would find it if he had to examine the entire crust of the planet, land and water alike, kilometer by plotted cubic kilometer! He set out to do just that; and it was thus that he found the Boskonian stronghold.

It had been built directly beneath a towering range of mountains, protected from detection by mile upon mile of native copper and of iron ore.

Its entrances, invisible before, were even now not readily perceptible, camoflaged as they were by outer layers of rock which matched exactly in form, color, and texture the rocks of the cliffs in which they were placed. Once those entrances were located, the rest was easy. Again he set his speedster into a carefully observed orbit and came to ground in his armor. Again he crept forward, furtively and skulkingly, until he could perceive a shimmering web of force.

With minor variations, his method of entry into the Boskonian base was similar to that he had used in making his way into the patrol base upon Radelix. He was, however, working now with a surety and a precision which had then been entirely lacking. His practice upon the patrolmen and his terrific bout with the four Lensmen had given him knowledge and technique. His sitting in judgment, during which he had touched almost every mind in the vast assemblage. had taught him much. And, above all, the grisly finale of that sitting, horribly distasteful and soul-wracking as it had

been, had given him training of inestimable value; necessitating as it had the infliction of the ultimate penalty.

HE KNEW that he might have to stay inside that base for some time; therefore he selected his hiding place with care. He could, of course, blank out the knowledge of his presence in the mind of any one chancing to discover him; but since such an interruption might come at a critical instant, he preferred to take up his residence in a secluded place. There were, of course, many vacant suites in the officers' quarters—all bases must have accommodations for visitors—and the Lensman decided to occupy one of them. It was a simple matter to obtain a key, and, inside the bare but comfortable little room, he stripped off his armor with a sigh of relief.

Leaning back in a deeply upholstered leather arm chair, he closed his eyes and let his sense of perception roam throughout the great establishment. With all his newly developed power he studied it, hour after hour and day after day. When he was hungry the pirate cooks fed him, not knowing that they did so. He had lived on iron rations long enough. When he was tired he slept, with his eternally vigilant Lens on guard.

Finally, he knew everything there was to be known about that stronghold, and was ready to act. He did not take over the mind of the base commander, but chose instead the chief communications officer as the one most likely and most intimately to have dealings with Helmuth. For Helmuth, he who spoke for Boskone, had for many long months been the Lensman's definite objective.

But this game could not be hurried. Bases, no matter how important, did not call Grand Base except upon matters of the most dire urgency, and no such matter eventuated. Nor did Helmuth call that base, since nothing out of the ordinary was happening—to any pirates' knowledge, that is—and his attention was more necessary elsewhere.

One day, however, there came crackling in a triumphant report: a ship working out of that base had taken noble booty indeed; no less a prize than a fully supplied hospital ship of the patrol itself! As the report progressed, Kinnison's heart went down into his boots and he swore bitterly to himself. How in all the nine hells of Valeria had they managed to take such a ship as that? Hadn't she been escorted?

Nevertheless, as chief communications officer, he took the report and congratulated heartily, through the ship's radio man, its captain, its officers, and its crew.

"Mighty fine work; Helmuth himself shall hear of this," he concluded his words of praise. "How did you do it? With one of the new maulers?"

"Yes, sir," came the reply. "Our mauler, accompanying us just out of range, came up and engaged theirs. That left us free to take this ship. We locked on with magnets, cut our way in, and here we are."

There they were indeed. The hospital ship was red with blood; patients, doctors, internes, officers and operating crew alike had been butchered with the horribly ruthless savagery which was the customary technique of all the agencies of Boskone. Of all that ship's personnel only the nurses lived. They were not to be put to death—yet. In fact, and under certain conditions, they need not die at all.

THEY huddled together, a little knot of white-clad misery in that corpse-littered room, and even now one of them was being dragged away. She was fighting viciously, with fists and feet, with nails and teeth. No one pirate could handle her; it took two of the huskies to subdue that struggling fury. They hauled her upright and she threw back

her head, in panting defiance. There was a cascade of red-bronze hair and Kinnison saw—Clarrissa MacDougall! He remembered that there *had* been some talk that they were going to put her back into space service! The Lensman decided instantly what to do.

"Stop, you swine!" he roared through his pirate mouthpiece. "Where do you think you're going with that nurse?"

"To the captain's cabin, sir." The huskies stopped short in amazement as that roar filled the room, but answered the question concisely.

"Let her go!" Then, as the girl fled back to the huddled group in the corner, he said, "Tell the captain to come out here and assemble every officer and man of the crew. I want to talk to everybody at once."

He had a minute or two in which to think, and he thought furiously, but accurately. He had to do something, but whatever he did must be done strictly according to the pirates' own standards of ethics; if he made one slip it might be Aldebaran I all over again. He knew how to keep from making that slip, he thought. But also, and this was the hard part, he must work in something that would let those nurses know that there was still hope, that there were a few more acts of this drama yet to come. Otherwise he knew with a stark, cold certainty what would happen. He knew of what stuff the space nurses of the patrol were made, knew that they could be driven just so far, and no further—alive.

There was a way out of that, too. In the childishness of his hospitalization he had called Nurse MacDougall a dumbbell. He had thought of her, and had spoken to her quite frankly, in uncomplimentary terms. But he knew that there was a real brain back of that beautiful countenance, that a quick and keen intelligence resided under that red-bronze thatch. Therefore, when the assembly was complete he was ready, and in no uncertain or ambiguous language he opened up.

"Listen, you—all of you!" he barked, savagely. "This is the first time in months that we have made such a haul as this, and you fellows have the brazen gall to start helping yourselves to the choicest stuff before anybody else gets a look at it. I tell you now to lay off, and that goes exactly as it lays. I, personally, will kill any man that touches one of those women before they arrive here at base. Now you, captain, are the first and worst offender of the lot." And he stared directly into the eyes of the officer whom he had last seen entering the dungeon of the Wheelmen.

"I admit that you're a good picker." Kinnison's voice was now venomously soft, his intonation instinct with thinly veiled sarcasm. "Unfortunately, however, your taste agrees too well with mine. You see, captain, I'm going to need a nurse myself. I think I'm coming down with something. And, since I've got to have a nurse, I'll take that red-headed one. I had a nurse once with hair just that color, who insisted on feeding me tea and toast and a soft-boiled egg when I wanted beefsteak; and I am going to take my grudge out on this one here for all the red-headed nurses that ever lived. I trust that you will pardon the length of this speech, but I want to give you my reasons in full for cautioning you that that particular nurse is my own particular personal property. Mark her for me, and see to it that she gets here—exactly as she is now."

The captain had been afraid to interrupt his superior, but now he erupted.

"But see here, Blakeslee!" he stormed. "She ought to be mine, by every right. I captured her; I saw her first; I've got her here——"

"Enough of that back talk, captain!" Kinnison sneered elaborately. "You know, of course, that you are violating every rule by taking booty for your-

self before division at base, and that you can be shot for doing it."

"But everybody does it!" protested the captain.

"Except when a superior officer catches him at it. Superiors get first pick, you know," the Lensman reminded him, suavely.

"But I protest, sir! I'll take it up with——"

"Shut up!" Kinnison snarled, with cold finality. "Take it up with whom you please, but remember this, my last warning: Bring her in to me as she is and you live. Touch her and you die! Now, you nurses, come over here to the board!"

NURSE MACDOUGALL had been whispering furtively to the others, and now she led the way, head high and eyes blazing defiance. She was an actress, as well as a nurse.

"Take a good, long look at this button, right here, marked 'Relay 46,'" came curt instructions. "If anybody aboard this ship touches any one of you, or even looks at you as though he wants to, press this button and I'll do the rest. Now, you big, red-headed dumb-bell, look at me. Don't start begging—yet. I just want to be sure that you'll know me when you see me."

"I'll know you, never fear, you—you *brat!*" she flared, thus informing the Lensman that she had received his message. "I'll not only know you—I'll scratch your eyes out on sight!"

"That'll be a good trick if you can do it," Kinnison sneered, and cut off.

"What's it all about, Mac? What has got into you?" demanded one of the nurses, as soon as the women were alone.

"I don't know," she whispered. "Watch out; they may have spy rays on us. I don't know anything, really, and the whole thing is too wildly impossible, too utterly fantastic to be even partially true. But pass the word along to all the girls to ride this out, because my gray Lensman is in on it, somewhere and somehow. I don't see how he can be, possibly, but I just know that he is."

For, at the first mention of tea and toast, before she perceived even an inkling of the true situation, her mind had flashed back instantly to Kinnison, the most stubborn and rebellious patient she had ever had—more, the only man she had ever known who had treated her precisely as though she were a part of the hospital's very furniture. As is the way of women—particularly of beautiful women—she had orated of women's rights and of women's status in the scheme of things. She had decried all special privileges, and had stated, often and with heat, that she asked no odds of any man living or yet to be born. Nevertheless, and also beautiful-woman-like, the thought had bitten deep that here was a man who had never even realized that she *was* a woman, to say nothing of realizing that she was an extraordinarily beautiful one! And deep within her and sternly suppressed the thought had still rankled.

At the mention of beefsteak she all but screamed, gripping her knees with frantic hands to keep her emotion down. For she had had no real hope; she was simply fighting with everything she had until the hopeless end, which she had known could not long be delayed. Now she gathered herself together and began to act.

When the word "dumb-bell" boomed from the speaker she knew, beyond doubt or peradventure, that it was Kinnison, the gray Lensman, who was really doing that talking. It was crazy; it didn't make any kind of sense at all; but it was, it must be, true. And, again, woman-like, she knew with a calm certainty that as long as that gray Lensman were alive and conscious, he would be completely the master of any situation in which he

might find himself. Therefore, she passed along her illogical but cheering thought, and the nurses, also being women, accepted it without question as the actual and accomplished fact.

They carried on, and when the captured hospital ship had docked at base, Kinnison was completely ready to force matters to a conclusion. In addition to the chief communications officer, he now had under his control a highly capable observer. To handle two such minds was child's play to the intellect which had directed, against their full fighting wills, the minds of two and three quarters alert, powerful, and fully warned Lensmen!

"Good girl, Mac!" he put his mind *en rapport* with hers and sent his message. "Glad you got the idea. You did a good job of acting, and if you can do some more as good we'll be all set. Can do?"

"I'll say I can!" she assented fervently. "I don't know what you are doing, how you can possibly do it, or where you are, but that can wait. Tell me what to do and I'll do it!"

"Make a pass at the base commander," he instructed her. "Hate me—the ape I'm working through, you know—all over the place. Go into it big. You maybe could love him, but if I get you you'll blow out your brains—if any. You know the line—play up to him with everything you can bring to bear, and hate me all to pieces. Help all you can to start a fight between us. If he falls for you hard enough the blow-off comes then and there. If not, he'll be able to do us all plenty of dirt. I can kill a lot of them, but not enough of them quick enough."

"He'll fall," she promised him gleefully, "like ten thousand bricks falling down a well. Just watch my jets!"

AND FALL he did. He had not even seen a woman for months, and he expected nothing except bitter resistance and suicide from any of these women of the patrol. Therefore, he was rocked to the heels—set back upon his very haunches—when the most beautiful woman he had ever seen came of her own volition into his arms, seeking in them sanctuary from his own chief communications officer.

"I hate him!" she sobbed, nestling against the huge hulk of the base commander's body and turning upon him the full blast of the high-powered projectors which were her eyes. "*You* wouldn't be so mean to me, I just know you wouldn't!" And her subtly perfumed head sank upon his shoulder. The base commander was just so much soft wax.

"I'll say I wouldn't be mean to you!" his voice dropped to a gentle bellow. "Why, you little sweetheart, I'll *marry* you. I will, by all the gods of space!"

It thus came about that nurse and base commander entered the control room together, arms about each other.

"There he is!" she shrieked, pointing at the chief communications officer. "He's the one! Now let's see you start something, you rat-faced clunker! There's one real man around here, and he won't let you touch me—ya-a-a!" She gave him a resounding Bronx cheer, and her escort swelled visibly.

"Is—that—so——?" Kinnison sneered "Get this, baby-face, and get it straight. You were marked as mine as soon as I looked the ship over, and mine you're going to be, whether you like it or not, and no matter what anybody else says or does about it. And as for you, chief, you're too late. I saw her first. And now, you red-headed hussy, come over here where you belong!"

She snuggled closer into the commander's embrace and the big man turned purple.

"What do you mean, too late?" he

roared. "You took her away from the ship's captain, didn't you? You said that superior officers get first choice, and they do. I am the boss here and I am taking her away from you. Get me? You'll stand for it, too—yes, and you'll like it. One word out of you and I'll have you spread-eagled across the mouth of No. 6 Projector!"

"Superior officers do not *always* get first choice," Kinnison replied, with bitter, cold ferocity, but choosing his words with care. "It depends entirely upon who the two men are."

Now was the time to strike. Kinnison knew that if the base commander kept his head, the lives of those valiant women were forfeit, and the Lensman's whole plan seriously endangered. He himself could get away, of course—but he could not see himself doing it under these conditions. No, he must goad the commander to a frenzy. Mac would help. In fact, and without his suggestion, she was even then hard at work fomenting trouble between the two men.

"You don't have to take that from anybody, big boy," she was whispering, urgently. "Don't call in a crew to spread-eagle him, either; beam him out yourself. You're a better man than he is, any time. Blast him down. That'll show him who's who around this base!"

"When the inferior is such a man as I am, and the superior such a one as you are," the biting, contemptuously sneering voice went on without a break, "such a bloated swine, such a mangy, low-down cur, such a pussy-gutted tub of lard, such a worthless, brainless spawn of the lowest dregs of the sourest scum of space, such an utterly incompetent and self-opinionated ass as you are——"

The outraged pirate chief, bellowing incoherently in wildly mounting rage, was leaping toward a cabinet in which were kept the DeLameters.

"—then, in that case, the inferior keeps the red-headed wench himself. Put that on a tape, chief, and eat it. Then, if you are too much of a lily-livered coward to do anything about it yourself, have me spread-eagled," the Lensman concluded, cuttingly.

"Blast him! Blast him down!" the nurse had been shrieking; and, as the raging commander neared the cabinet, no one noticed that her latest and loudest scream was "Kim! Blast him down! Don't wait any longer—beam him down before he gets a gun!"

But the Lensman did not act—yet. Although almost every man of the pirate crew stared spellbound, Kinnison's enslaved observer had for many seconds been jamming the subether with Helmuth's personal and urgent call. It was of almost vital importance to his plan that Helmuth himself should see the climax of this scene. Therefore, the communications officer stood immobile, while the profanely raving base commander reached the cabinet, tore it open, seized a DeLameter, and swung it savagely toward him!

TO BE CONCLUDED.

The Mental Ultimate

by

POLTON CROSS

When adaptability is so perfect as to defy Death—Nature still finds an end——

I HAVE NOT long to live, nor has any man since time began looked forward so eagerly toward death—not as a means by which to escape an incurable disease or an irrational boredom of life, but to break free of the bonds of inhuman intelligence! Strange? Perhaps you will not think so if you ever find this story. I know my thoughts will register every detail on the machine I have left far behind me on the world of Earth—somewhere in space, somewhere in time——

My name is Nathan Bryant and I was born in the year 1921. I can remember that my peculiar gift first came to my notice when I was ten years old. I have recollections of puzzled parents, of a busy home in New York, of my extraordinary career at school wherein I mastered the most difficult subject in a quarter of the normal time allowed. Then, at eighteen, I found myself thrown on my own resources by the death of my parents in an automobile accident.

The world did not frighten me. I knew more about it than most men of wide experience. Business, sociology, religion, science, little known researches—all these things spread out before me like a vast map of information. I could have followed any of them as a career and made a sublime success of it.

Some people called my mind "photographic". Others called me a "mental phenomenon" and urged that I take up a stage career. What they said did not interest me. I knew I was the master of whatever I turned my mind to. But at that age I did not fully appreciate *how* powerful was the gift I possessed.

It seemed quite a simple thing to me to discourse with learned men upon the multi-integral calculus, the exact fundamental nature of energy and gravitation, and the pure conceptions of fourth, fifth and sixth dimensions. Yet, clever as these men were reputed to be, they struck me as rather doltish. Not able to understand the sixth dimension! Not able to conceive how space and time interweave with consciousness!

I was twenty when I began my private researches. It was also the time when I began to realize that I was indeed unlike the multimillions of people around me. I was in truth an intellectual giant, and therein lay a certain odd fear of myself.

In my research work I found that I needed assistance. I obtained it in the form of a plain-faced, brown-haired man of my own age—Dick Emerton by name. He was a shrewd-enough fellow, with a brutal directness of manner and a good deal of common sense. He never once made any remarks on my own singular gifts until the day when I added twenty columns of multiple figures simultaneously and gave the right total. To my surprise he told me it would have taken the world's greatest mathematicians nearly a week to accomplish that feat.

He was last of natural men——

"But why?" I asked, puzzling over them. "What's the matter with everybody, Dick? It's like trying to carve steel with a putty knife to drive sense into people. You're not much better either, with all due respect."

"I'm normal, that's why," was his quiet answer. Then he started to study me reflectively. "To outward appearances you're all right," he resumed thoughtfully. "You have a large forehead—but by no means exceptional—gray eyes, black hair, and yet—— Well, it isn't the first time I've heard of your mental feats, Nat. I only really answered your advertisement because I wanted to get a closer look at the man who fooled those math professors. Up to now I've thought you a phony. Now I see how wrong I've been. Don't you realize, man, what intellectual power you've got?"

"Sometimes I do wonder about it," I

admitted. "And yet why should I be so abnormal? I was born naturally; I've never had an accident, no blows on the head or anything like that. Seeing and knowing things is pure simplicity to me, so much so that I can't figure why nobody else can do it."

"In a way you're an intellectual freak—like double-headed frogs and bearded ladies, if you'll forgive the simile," Dick said. "This research of yours, for instance. Do you realize that nobody on Earth, save perhaps yourself, understands the physical relation between matter, time and space?"

I smiled at him. "Frankly, I hadn't thought of being alone in my ideas. You see, it's so plain to me. With sufficient effort I could live a hundred years back in time, following a past timeline in the millions of possibles that exist."

"Too much for me." He sighed, shaking his head. "I'm afraid you'll have to get a fresh assistant, Nat—but I doubt if you'll ever find one. I've tried to understand your ideas, but it's no dice. You assert that a physical body does nothing except what the mentality commands. That may be all right in pure metaphysics, but in science it doesn't match up. According to your reckonings, mind power can offset anything—even death!"

"Certainly!" I declared firmly. "My body is only the carrier for my intelligence, and my intelligence is the one dominating force. There have been others in the past who have proven that fact—for instance, Enoch, Abraham, Jesus of Nazareth—all of them masters of mental power over physical."

At that Dick shrugged. "Well, I guess I'm only a straight laboratory technician, and for that very reason I'll have to leave you. I'll make one suggestion, though—go and see a psychoanalyst and see what he thinks about your brain. You're an abnormality and owe it to yourself to discover the truth. That is, if you're interested?"

"I'm interested in knowing why everybody else is so dense," I answered thoughtfully. I suppose that sounded egotistical.

In any case, I followed Emerton's advice and went that very same afternoon to see Professor Calden, one of America's leaders in psychoanalysis.

I CANNOT detail all he said, or the tiring experiments he put me through. But the gist of it all was that I possessed cerebral hypertrophy. According to him, the hypertrophy was in a progressive state which would mean a constant accumulation of intelligence until the thing finally killed me from sheer pressure.

The diagnosis should have frightened me, but it didn't. I knew inwardly that I was the complete master of my body. I knew, too, that the great Professor Calden was for once utterly wrong in his reckonings. It was not that I had a type of hypertrophy, but something else—a something which self-analysis could not determine, in much the same fashion as a surgeon sometimes cannot diagnose his own ailment.

I returned alone to my researches, somewhat embittered by the complete isolation engendered by my strange genius. There were times when my mental excursions into the profoundest realms of mathematics and cosmic things wearied me a little. I longed for the company of a mind like my own, yet remained isolated, shunned by very reason of my superhuman powers.

By the time I was twenty-six I had solved all the sciences of Earth and brought each one to fruition in my own mind. I discovered the real meaning of electron waves, of the vast possibilities lying beyond the velocity of light. I found other radiations moving at speeds far in excess of 186,000 miles a second. Instead of the normal 70 octaves of vibration which had been known, I found

and classified as many as 137! Yet where lay the use of all these discoveries? Nobody could understand me!

I returned to my studies in my laboratory in the city, and the more I delved, the more I realized that Professor Calden had at least been right in one thing —my mental powers *were* increasing, to such an extent that I was becoming rather afraid of myself. There seemed to be no barrier to the growing force of my mind.

I clearly remember what a stunning shock I received when my little dog, Mopes—my only companion in those dreary early years—came into conflict with my mind. In an exuberance of mischievous energy he jumped on the bench beside me and overturned a glass container filled to the brim with a fluid which I knew contained the elements of a startling new life. In the heat of the moment I flew into a rage and cursed poor old Mopes for all I was worth.

Then I relaxed, horror-stricken, to see him gaze at me dumbly for a moment and then drop motionless to the bench. All traces of life had literally been blasted clean out of him by the power of the thoughts behind my words!

Probably I could have brought him back to life by the same uncanny mental power, but that was something which did not occur to me in my abject despair. I only thought of it after I had buried him. For days I was a victim of acute melancholia, overwhelmed by the knowledge of the terrible gift—or curse—I possessed. Nothing was safe from me.

If the incident with Mopes did nothing else, it at least provided me with the basis of a new mental science—the control of atoms and electrons into any desired formation by sheer will power. I tried little things at first and was unsuccessful. Then as months sped by I began to merge inorganic objects out of apparent nothing.

Knowing by heart all the atomic elements making up various objects, it was not so difficult for me, though I suppose the mental feat of memorizing the exact atomic structure of every form of inorganic matter would be considered prodigious. I can only say it did not appear so to me.

To my delight I succeeded in merging common stones, minerals and peculiar isotopic metals into being—each time with a sharp explosion as the atomic aggregates of the air suddenly changed their courses and patterns to make up the new element.

I fingered diamonds of stupefying size, gazed on emeralds of surpassing value, even created radium and sent it in lead-x containers—lead-x being an element of my own discovery and having Periodic Number 95—to the principal hospitals of the country. Nor did I send it by any ordinary method. No, I *willed* it there and had my first good laugh in years wondering what the various hospitals thought of their discoveries.

All the world's wealth was at my command had I wished it—which I did not. Willing things of overwhelming value into being was interesting at first, but it soon palled. I had money enough in any case. If I had more, I could not spend it. So I went further and tussled for five more weary years in an effort to create *organic* matter.

ORGANIC matter certainly represented a profound struggle. Beyond memorizing all the atomic units of inorganic matter, I had now to tabulate every known constituent of living matter and assimilate all the data in my mind. Written notes were quite useless, for in a mind-effort the whole pattern had to be set infallibly in my thoughts before I could even start.

But little by little I mastered every detail—the primary patterning of the electrons and their build-up into molecules, their exact position in the scheme of the whole, the entire sequence of stresses, strains and co-relationships.

From this stage I went on to the conception of cells, nerve connections, atomic structure and a myriad other details of almost bewildering complexity.

And I was successful! I brought a mouse into being and watched it move around the laboratory under the influence of my commands until an accidental fall into an uncorked vat of acid put an untimely end to it. Still I had seen enough—if a mouse, why not a human being? That thought obsessed me. Why not a *woman?*

Lord! How that thought grew upon me! I realized that it was perhaps the absence of a woman that had made my life so dreary and desolate. Normal women were pure anathema to me, and I to them. Thereupon I set to work to conceive the mental image of the most perfect woman ever known.

Four more years went by in patterning the unbelievably complex organisms. But at the end of that time I produced *her*—to the accompaniment of an explosion that sent me stumbling backward. When I recovered she was standing there in front of me, motionless—a creature as white as alabaster, flaxen hair flowing round her perfectly shaped head. Her clear blue eyes were looking at me steadily, yet with a certain indefinable emptiness.

"Why don't you speak?" I whispered hoarsely, moving slowly toward her. "Speak, I say! Walk!"

She commenced to move toward me, only stopping when I commanded her to do so. But still no word passed her red lips. I reached out and gripped her shoulders. They were warm with the flow of life, but——

Slowly, gradually, I began to realize the bitter impossibility of the thing I had done. A woman, yes—a creation of my will and more beautiful than any woman had ever been—born out of atoms by mental power alone. Yet she was devoid of the one vital thing I could not give—*intelligence!*

For an instant my mind flashed back to the mouse I had made. It occurred to me that it had obeyed only the stimuli of my commands. Its sheer inability to think for itself had led it to walk blindly over the bench edge into the acid vat.

And now? I stared anew, only to reconvince myself. This woman had no intellect—only a brain that responded to my will, but which was, itself, dead, gray matter.

I stood and concentrated, slogged my mind with all the power in my possession to bring consciousness and mental entity into her stillborn brain, but it was wasted effort. I had encountered a locked door. Intelligence could not *beget* intelligence. It was something beyond my reach.

The despair of that realization! I gazed speechlessly at her living dead body, the expressionless face and clear eyes—— Then, with a stream of livid curses, I shattered her into a thousand pieces that swirled, misted and vaporized into the air until there remained not a trace.

I thudded down into a chair and reviled the fate that had made me a genius. An hour passed before I was the master of myself again.

FROM THAT TIME onward I dabbled no more in organic imagery. Instead I turned my mind to world affairs, forced myself out of my hermitage and took my place amongst the apparent giants of civilized progress. Once again I was rewarded with honors, degrees, dictatorships, presidencies—the whole gamut of supreme power.

I dispensed with them all, told the rulers what to do and saw that they did it. Without difficulty I found a solution to every world problem and became an unwilling demigod.

That state did not please me. I was still looking for something I had missed. Again I dared to love a woman—a natural one, of course, and one of considerable intelligence so far as normalcy

goes. Everything went well until one day she did something that irritated me —as had poor old Mopes. Before I knew what I had done she lay dead at my feet.

No longer did I doubt that my intellect was a curse and not a gift. I vanished from the public eye that day and vowed never to mingle with humanity again. No one could say how the woman of my affections had died. It was diagnosed as heart failure from extreme shock. But I was her murderer—an even greater one because I had really loved her.

I repeat, then, that I left the perfect world I had created and plunged into the study of mental space and time conception. Space I did not find difficult to conquer. My body was the complete slave of my will and felt no change from earthly to interplanetary conditions. By the merest intellectual effort I projected myself from Earth to the arid, sun-drenched airlessness of the Moon and found it barren.

I traveled to Mars to find traces of a decadent civilization. Venus lay as a steaming, torrid wilderness, lashed eternally by frightful winds or—during sudden cessations—blanketed in dense and streaming mists. The planet had little to tell me.

The outer planets were no more difficult to reach, but it did entail considerable mental adjustment to adapt myself to their crushing gravitations. Nowhere, from Jupiter to Pluto, did I find a trace of anything resembling life.

My attention turned to the only other avenue of exploration—time. My early studies of the problem had revealed time as possessing millions of different future and past courses, it being a chance as uncertain as an electron wave which course Earth would take in its forward progression. The past path was known, of course. But I could easily move back along any of the paths *not* traversed and so escape annihilation by cancellation of my own birth.

The method by which it might be done was obviously a mental one—to force my mentality back along any of the postulated, untraversed tracks and by that very fact force my body, also. That involved adjusting my body to the movement, the changing air and the altered ratio of different time.

At first it was sufficiently hard to project myself a week past into an unknown path of possible happenings. I managed it successfully, merging from one state to the other without any undue difficulty. My body flawlessly obeyed my will.

From a week I extended to months, and then to years—spent a considerable interval exploring the might-have-been paths of the past, following the varied evolutions man might have taken had the law of chance operated differently.

But finally the past grew monotonous; there was so much that had already been done. My real course lay in the future. Perhaps there I could find a brain capable of explaining what was really wrong with me, why I possessed such unhuman powers.

Just as I had resolved to move futureward, however, I made a singular discovery in regard to myself. I was, amazingly enough, becoming smaller in stature! The fact confounded me utterly. I had decreased an inch in height and width in one week! I put it down to a contraction of the cartilages from my time-traveling experiences. But at the back of my mind I had an idea that this was not altogether correct. There was some other reason, not entirely clear to me.

I tried finally to ignore it and instead busied myself with the construction of a recording machine able to operate from mental vibrations. It had occurred to me that mankind might be interested in knowing future possibilities, or even my own strange odyssey for that matter.

The machine was simple enough—to

me, that is. It consisted of a central vibratory mechanism somewhat on the fashion of a seismograph, only far more delicate in balance. The impact of my mental waves from future time would train directly upon it and set in motion an intricate keyboard resembling that of a typewriter, which in turn would write down in words whatever thought impacts were directed upon it. I wondered when I completed the device and supplied it with an endless stack of paper what, exactly, contemporary inventors would think of it.

When the machine was finished I was four inches less in stature. In three weeks I had dropped from five feet eight to five feet four. The fact settled in my mind as a profound perplexity. I tried to couple my age with the cause, but there was no apparent connection.

So, baffled, I willed myself into the future.

I FIND IT unusually difficult to express the singular fascination of wandering unhampered through the countless variations of possible future times.

Without the least effort, so perfectly was my concentration and knowledge schooled, I willed myself wherever I wished to go. I was deathless, a searching wanderer, oblivious to all conditions, since my mind made it possible for me to immediately adapt myself to whatever state I found—whether it happened to be space, fire, water or solids. At first I made the mistake of miscalculating the Earth's journey through space, and found myself materialized in a star-ridden void. After that my mind took good care of the defect.

The wandering was glorious, and yet strangely lonely. There is little real happiness in being the sole possessor of a strange genius. I needed companionship—I literally craved it—yet it was still something that eluded me.

I merged into the year 2139 as my first experiment; in fact I merged into it twice and saw two different postulations of the future. In one, the Earth was nearly empty of people, war-shattered and desolate; in the other there had been no war and man had reached a peak in scientific achievement.

In this lovely world I lingered for a while, a stranger amidst its kindly peoples—but still my genius was something they could not understand and the old curse of isolation returned to me. I was too clever. I moved on, but not before I rechecked my measurements. I was now only four feet high, and still diminishing!

This puzzle was always with me, always defeating my efforts at analysis.

I went onward in leaps of hundreds of years and saw mankind wax and wane according to circumstance and line of probability. Monstrous cities that seemed all glass rose out of hazy sun-drenched landscapes. People, delicately attired and ineffably lovely, walked in the midst of these paradises. I did not stop, I went on and on, drawn by a magnetic all-consuming desire to behold the remoter futures.

I ultimately paused when I beheld civilization at the apparent close of its life. The vast cities were changeless and gray, the Sun less brilliant, the sky less blue. And it was here, in the decadent city of Dijanipol, in the year approximately Twenty-two Million A. D., that I encountered Forunda, supreme intelligence of the Earth's vanished peoples.

With my strange powers of mental assimilation it was easy enough for me to find him. He was seated brooding alone in the ruins of a once superb palace—a little, emaciated figure of a man in tattered garments. His arms and legs were spindly, his chest narrow, his face pinched. The most dominant features about him were his extremely large and intelligent eyes, in which there seemed contained the whole history of a race's knowledge and the high, smooth forehead rising to a hairless skull.

He regarded me with but little surprise as I merged out of the air. I was far smaller than he—now a mere foot in height. The faintest suggestion of a smile came and went on his dried and wearied face.

"Nathan Bryant, the mental ultimate?" he questioned. Though his voice was swift and his language oddly truncated, my mind quickly converted his thought waves into sense.

"Yes," I assented. Then I looked round the great crumbling room. Long minutes I surveyed the eroded pillars and fissured walls while Forunda sat motionless in his age-stained chair—bony, veined hands gripping the arms in imagelike rigidity.

Presently he spoke again. His fluting voice brought my wandering gaze back to him.

"You are not entirely a stranger, Nathan Bryant. Records of past time have revealed the story of your departure into time from the year 1944. Remember that you left a machine in that year to record your thought impressions as you journeyed. That machine is still working—it is the last machine in this shattered, passing world. It will go on recording until you pass away. By the same paradox it is recording in every age preceding this one. Tell me, Nathan Bryant, why did you seek me out?"

"Because you're the only person likely to answer two very strange questions," I answered broodingly. "Can you explain the reason for my enormous intelligence, and why do I perpetually shrink?"

He mused for a time, narrow chin on clawlike hand. Then his domed, veined head nodded slowly.

"Yes, I can explain it. But I shall have to ask you to allow yourself to remember 1944 for a moment. When you lived in that age were you not aware that a Russian scientist, Vanlowski by name, postulated the conception of a linked brain? His theory was published in 1932, but was debarred from world-wide acclaim by reason of its striking improbability. Vanlowski averred that if a human being could be born in full possession of *all* his brain power he would be a super genius, at one with the cosmos. Every human being has five times more brain matter than he ever uses. That fact has been proven time and time again.

"Between the used portions and the areas of the subconscious, conative and ideative sections there is no link. A normal brain has to embody all those powers in a very small space and is, in consequence, ineffectual. But if there *were* a link between the unused portion and the normal section, it would place the possessor in control of all his powers—able to project his mind with a force five times in excess of so-called normalcy. He would be a mental wizard, able not only to understand the conscious but the subconscious as well—able to materially project his ideas instead of theorizing them. He could bend the very atomic fabric of the universe to his will.

"Such a brain link would of necessity be a nerve connection. You, Nathan Bryant, have that connection. How, or why, will never be known. You are a caprice of nature, the very thing that Vanlowski thought might one day happen. Prodigies are known through all history, and freaks. But you are the greatest of them all—— Yet in another sense you are the only perfect man because you have a *complete* brain. That little neuronic brain connection has given you supreme power, but for such a power nature demands a certain price."

The thin voice paused impressively. I looked into those wise, age-filled eyes, and waited.

"The price," he resumed, "is extraordinary death in return for your extraordinary life. You have assimilated natural death so flawlessly that you cannot grow old or feeble in the accepted sense.

Instead, you have decreased in stature. I do not need to tell you that in the animal there is progressive katabolism—the constant breakdown of material. The very energy of the body finally burns it out. In the plant, one has the opposite effect—anabolism. But in your case you have both katabolism and anabolism in a state difficult to understand.

"Since you are able to defeat ordinary katabolistic death by mental power, you have produced an anabolistic state within yourself—an eternal balance of energy preventing you from ever becoming older. But nature, forced to find an equilibrium somewhere, has forced you to become *smaller!* The cells of your body, instead of breaking down, simply change into radiation and pass away into the immediate surroundings. Little by little the atoms of your body are parting company. You are shrinking—shrinking—but will remain the master of your body until you are reduced to the last electrons remaining inside your super brain. Then electronic orbits will close smaller and smaller until they achieve coincidence with the proton. When that happens, you will pass away—will become a minus quantity."

"So that is it," I said with slow bitterness. "And no matter what states I pass through in my descent into smallness, I shall escape death until the end because of my profound adaptability."

He nodded slowly. "That is inevitable. Not always can supreme genius be classed as beneficial, my friend."

For a long time I stood in moody silence. Then, taking a grip on myself, I went on talking to him. For two hours we discussed the history of the human race, of the slow descent of Earth into cosmic dust. He represented the last natural man alive—a category into which I did not fit. For seven generations he had brooded there in the shadows of crumbling achievement, a lone man battling still with the multiple problems of existence. Yet how small his battle seemed by comparison with mine.

When I finally departed he was still seated in his chair, the somber finality of all that was left of humanity. Never had I felt so apart, so alone.

ONWARD I WENT, and onward, growing smaller with my journeyings. Earth became ice-sheathed, the Sun a dull red and nearly extinct ball. Through unguessable ages I moved, pausing ever and again to wonder at the increasing giantism of things about me as I shrank to inconceivably tiny proportions.

Smaller and further. Smaller——

I lost all conceptions of Earth. Perhaps it passed into space—perhaps I became so small that I slipped in between the interstices of matter and became subatomic——

My only realization was of being amidst the eternal stars and vast, empty spaces. But there was a certain movement! Yes, definite movement—and it was upon *me!* I seemed to be smothered with some strange parasitism.

Eyes, ears and ordinary organs had long ceased to mean anything. I only understood by the sheer essence of thought, and little by little the strange explanation of the parasitism came home to me. I had become a planet—a thinking, electronic planet with life spawning upon me, a life that was moving from birth to death with incredible rapidity!

Almost before I realized it, the strange life on my fast-decreasing body had reached the end of its course. I was revolving and moving, no longer in human form, but a perfect ball pursuing an incredibly fast and narrowing orbit round a protonic Sun.

I watched it as I circled round it and thought of the immeasurable distances of space and time I had covered. I was about to die——

The entire universe seems nothing but blinding flame. I am hurtling toward that enormous incandescence——

MUTATION

We begin a new year together, with this issue. January, Nineteen Hundred and Thirty-eight. And I can begin this year with an announcement that will, I believe, prove very interesting to us all. To you, for what the next issue will bring; to me, because ***Astounding Stories*** must follow nature's plan of evolution, a plan that has been tested and proved through two thousand millions of years.

Does evolution apply to ***Astounding Stories?*** Certainly. Nature has developed in those twenty million centuries the soundest conceivable plan for advancement—try, test, and retain the good.

We will try, beginning with the next issue; you and ***"Brass Tacks"*** will test. And what ***you*** like, I will retain. But I feel sure that you will like this, the first of a series of ***mutant issues.***

Nature advances animal life by mutants, by the sudden production of a new, slightly yet fundamentally, different animal. A dinosaur laid an egg once that hatched to a thing not quite a dinosaur. Not yet a mammal, for had that full step been made at once the world's lone mammal could not have reproduced.

Changed, but not out of touch. The change is small, but fundamental, in each mutation nature makes.

In each of the ***mutant issues*** that are to come during 1938, the change may seem small in itself, but it will be fundamental. It will help to determine the ***direction*** that the evolution of ***Astounding Stories*** and science-fiction must take. Like nature's mutations, ***mutant issues*** will not be frequent; only when a genuine, fundamentally different and original thing is to be tried, will I announce a true ***mutant issue.***

But I promise you this: when I do announce a ***mutant issue***, it won't be bluff. I'm going to have something genuinely new to offer before I make that announcement, so don't expect them to be frequent. Two, or at most three times a year will be all we can hope for. But I'll let you know in advance when it's coming, and it will be something worth noting.

The features which bring out those announcements must represent the ***first*** of something in science-fiction. Each will open up for development an entirely new field of science-fiction advancement, just as each of nature's mutants opened a new field for evolution.

There will be no greater number of copies available in February, but I believe that people who have never before joined our group will buy that issue. I particularly want all of you who have regularly followed ***Astounding Stories*** advance to see that February issue and tell me in ***"Brass Tacks"*** —yes, and in ***"Science Discussions"***—what you think of it. Be sure you are not too late at the news stand.

The Editor.

Conservation.

Dear Editor.

In his recent letter Mr. Rudolph Castown implies that the idea of time travel is incompatible with the law of conservation of mass and energy. I believe that his reasoning is wrong in this case, and that his difficulty lies primarily in the assumption that a body moved in time is transported into a different universe. According to Einstein, time and the three normal dimensions are so related as to form a continuous, inseparable medium we call the space time continuum. Time is in no way independent of the other components of our universe. Hence a fixed mass moved in time is by no means lost from the universe, the action being analogous to a shift along any other dimension. I hope my point is made clear.

How, Mr. Castown, do you conclude from the tangent graph that plus and minus infinity coincide? The tangent is a discontinuous function and graphs as a series of curves from minus infinity to plus infinity, then breaking sharply to begin again at minus infinity. At no point do the curves coincide. I will concede, however, that plus and minus infinity may be numerically equal, but the minus sign cannot be disregarded. Hence $(\epsilon/\pi)^{-\infty}$ becomes $\frac{1}{(\epsilon/\pi)^{\infty}}$ which is the reciprocal of the first space $(\epsilon/\pi)^{\infty}$ and therefore cannot be equal to it.

I liked your last theory, Mr. Castown, and agree that the subject of so called supernatural phenomenon receives far too little attention.

I have seen several letters that discredit the idea that escape velocity applies to rockets. I, for one, fail to see how it does, but no one seems to want to challenge this. If you believe it does, let's have your arguments. I would like to discuss this problem.—Stuart Parsons, 423 7th Street, Saskatoon, Saskatchewan, Canada.

"He's right."

Dear Editor:

I was interested in Mr. Campbell's letter on atomic power possibilities, but I'd like to add a needed comment to that. One of the great reasons why atomic power has not even begun to leave the laboratory is the purely practical one of economics. That applies equally to a large number of "free power" projects. Falling or flowing water appears to furnish costless power, tides and rivers alike to go on forever at no charge. Sun power likewise appears as the ideal, costless power. Atomic power, allowing the development of a generator capable of releasing it under control, would supply power from a fuel of zero cost.

But—sadly—all those beautiful "free power" projects are much too expensive to be commercially feasible. Today, many a river is wasting thousands of horsepower over rapids and falls, while the falling water serves but one useful purpose—to cool the condenser tubes of a steam power plant. Neither sun, tide, nor river actually furnishes free power—because it must be harnessed. The great power plants at Niagara—are steam plants.

There is sound reason, a law made by man but not of man's choice | economics. Electrical engineers have calculated—and proved—that if you could build a perfect plant, a power unit so ideal that it burned no fuel, required absolutely no attention, never needed repair, and would function forever at a cost of 200 dollars for each kilowatt of power-plant capacity installed—it would lose money!

It seems incredible, but it is true, and understandable. Interest must be paid on that investment. There are no charges for the fuel that goes forever, the power plant that goes forever—but the interest goes forever, too. A coal power plant costs for fuel, repair, attention, a hundred quite unsuspected things. But it costs less to build. It comes surprisingly close to that no-attention no-repair ideal anyway. When a steam turbin is started, it is expected to keep turning, producing power constantly, for two solid years without a pause for a single instant. Two years, and it is stopped for inspection, checked, and restarted for two more uninterrupted years of service. The generators are over 96% efficient. The turbines, boilers, all equipment attains unbelievable efficiency and reliability, and a minimum of human care is needed.

And—the interest charges are less, they don't go on forever, because the plant can make enough money to pay off its debts—simply because that interest charge is less.

The Passamaquody Bay tidal power project was abandoned because it would have exceeded that 200 dollars per-kilowatt-of-installed-power limit.

To those so interested in mankind's long-time advancement as are we readers of this magazine, it may seem that this is an unworthily gross materialistic viewpoint of a problem of such vast importance to Man's advance. It is not, because money, capital and interest, are measures of human effort—no more. I expend effort and thought to earn a dollar. Because of an ideal, I may turn it over to a research foundation. I have, in effect, made my effort available to the research institute.

Human effort invested in an atomic power plant at a time when atomic power has not yet been sufficiently perfected for competition is not an advance to the human race, it is a retrogression. Thousands of man-hours of effort expended uselessly.

Those man-hours wasted should have been expended in research, not building the unsuccessful plant. They should not be expended in tidal power, sun or river power, because human effort invested in coal plants produces a higher return in lightened labor until that time when atomic power relieves coal of its work forever.

Research is not wasted human effort, because it can never be truly called unsuccessful. Though the desired goal may not be attained, the knowledge that the attempted course is a blind alley is valuable wisdom; it may, for instance, prevent the building of that unsuccessful atomic power plant that would stand a useless monument to human effort honestly expended, and forever lost to Man's advancement.

Capital is concentrated human effort; interest the measure of its return in lightened labor. That is the only way to determine whether a thing is an advancement or a retrogression in Man's evolution.—Sincerely, Arthur McCaun, 761 Scotland Road, Orange, New Jersey.

Spaceship? Wandering planet!

Dear Editor:

I'd like to add my bit by answering a few of the letters as I see them.

Mr. W. Hooper, in the Nov. issue, presents a problem about a clock. In answer, Mr. Hooper, there is a flaw in your reasoning. In one hour the clock would show 12:30 P. M. and would appear to the observer to be a half of a light-hour away. The clock would take a half hour to get to this point, and the light would take a half hour to get back, covering the full hour as presented. Similarly, the clock would show half a year's lapse of time after being away one year.

Mr. De Seis, you're right; a man would not freeze instantly, but, if he were fairly distant from any matter, would remain warm a long time.

Mr. Campbell's letter is one of the most interesting I've read in Science Discussions.

Now I would like to present one or two problems of my own.

What would happen if a quantity of air from earth's atmosphere were to be removed to the outermost reaches of space as we know it, or even beyond the gravitational attraction of any large mass? Of course, it would first expand, due to internal pressure (Brownian Movement). But it would not freeze solid, or anything of the sort, at least for a long time. Now, how much would the gas expand? I maintain that, after the gases had reached a certain stage of expansion, the force of gravity would nullify the weakened force due to the Brownian Movement. This gravity, the attraction between the molecules of the gases, would, of course, depend inversely on the square of the distance. But this ratio is not as great as that of the reduction of force due to the internal pressure, and at some point the two should neutralize each other and the expansion should cease. Now, would it be possible for a spaceship to be so huge (which it would probably have to be, anyway, for interplanetary and interstellar travel) so massy, that the gravitational attraction of this hulk for the air inside, and the attraction of the air itself (these being the only gravitational forces in that vicinity large enough to count) will stop the expansion at a density still capable of supporting human life? I don't say it would; I am only putting forth a theory which is as yet not backed by calculations or statistics, so there is room for criticism. However, if this were possible, it would do away with the fear of losing the air in a space ship through puncture or leak.

Another point: Space itself is cold, nearly absolute zero. I say nearly, because cosmic dust, always present, radiates some small amount of heat. But a ship in space ought not to lose heat very rapidly at all. The only way of the three possible ways of transmitting heat would be radiation, as the ship is in a vacuum, and the rate of radiation is small. If the inner surface of the ship were completely and highly polished, it would further reduce the rate of radiation. Besides, light and heat are supposed to travel through vacuum, not as light and heat, but as electro-magnetic waves, slightly different (light and heat are forms of energy derived from electro-magnetic waves). When coming into contact with any matter, these waves are changed into light and heat as it does when touching the upper reaches of our planet. If the outside of the ship were black to absorb all the energy possible, it seems to me, the total heat from the stars and the sun would not only neutralize the radiation from the ship, but keep the temperature, perhaps even more than comfortably warm. Don't forget the black outer surface of the ship would absorb all the heat touching it (or perhaps, more accurately, most). The earth only gets the heat from the sun after much of it has been deflected by layers of gases and ionized particles, and we're quite warm in summer.

If these two things were possible, two of the greatest supposed dangers in space travel would be overcome. I'd appreciate any answers to this, both constructive and destructive criticism.

About the material at the core of the earth; I don't believe it's sufficiently different to be called a fourth state of matter. From the description, it seems to resemble that old object of comparison and discussion, whipped cream. Whipped cream can be poured like a liquid but retains a form without flowing, thus it's neither a liquid nor a solid. But it's surely not a fourth state, just an in-between state.

I follow the other discussions in Science Discussions with interest. It's a very worth while column.—Lionel Herman, 5744 Pershing Avenue, St. Louis, Missouri.

BRASS TACKS

"Brass Tacks? Yes!"

Dear Editor:

I have just bought the November issue, and when I saw a small Brass Tacks, I decided I would write and tell you that I wanted Brass Tacks back. Science Discussions is just a hodge-podge of Xs, Ys and Zs.—Raymond Barry, 1303—14th St., Bradenton, Florida.

"Yes, and——"

Dear Editor:

Another great step in the history of the magazine! I was not as surprised as I was satisfied at the return of Brass Tacks. Over the past

few issues our old "mag." seemed to have something lacking. Not in the stories, for they were excellent, but in the magazine itself. You guessed it—Brass Tacks. It's a great feeling to like a story and know that others have the same ideas. *Now* if any one wants to argue over theories let them use the Science Discussion columns. We who are interested in the improvement of our magazine (can that be possible?) have a barricade—a storm cellar.

The November issue is a memorable one. "The Golden Horseshoe," by Burks, was very thought provoking. No. 1 story of the month.

"Queen of the Skies" and "Marlnorro" tie for second honors. I give the latter a small edge though, because it illustrates how other beings think in relation to Man.

"Lost in the Dimensions" would have been more appreciated a few years ago. We have had too many "time stories" as it is, although it was good.

"A Surgical Error" was good. It had a new plot and a major story could have been made out of it. The author evidently must have been in a hurry to finish it. So much could have been done to the story.

"Galactic Patrol" continues its pace. Long may E. E. Smith live!

Your last three covers are a light shade which makes them stand out.

Campbell, Jr.'s, articles are still going strong, although there must be an end somewhere. This is the eighteenth.

The addition of other scientific articles is very much appreciated. If I ever run out of twenty cents each month, I'll go crazy.—Mark Reinsberg, 430 Surf Street, Chicago, Illinois.

"Yes—but——"

Dear Editor:

I would like to voice my opinion on the restoration of Brass Tacks. I used to enjoy this department immensely but the substitution of Science Discussions was a vast improvement. However, I believe that a department for comments on the stories is also necessary, and if it does not interfere in any way with Science Discussions I am entirely in favor of it. As for the fellows that kick about the stories being crushed by the weight of science in them, I recommend a diet of ghost stories, Mother Goose yarns, or what have you. Certainly not science-fiction. As a matter of fact the stories that contain true science are altogether too scarce.

My own comments on the stories are as follows:

"Galactic Patrol" is so far a fine novel. Keep up the good work.

"Crystallized Thought" was outstanding, more stories of this type, please.

"Released Entropy" and "Frontier of the Unknown" were both excellent.

I enjoyed "What are Positrons" and "Superfast Eyes" more than any articles for a long time. Let's have more on atomic physics.

The general run of stories is good, and I think "our mag" is head and shoulders above any other publication of its type on the market. —Stuart Parsons, 423 7th St., Saskatoon, Sask., Canada.

"Old Timer."

Dear Editor:

This letter is just to thank you for the mighty fine job you, associates, and authors have produced in the October, 1937, issue of the magazine.

"Galactic Patrol" is superb—magnificent in the grandeur of its conceptions—thrilling, too, every page of it.

"Stardust Gods" is as fine a story of the fantasy type as I have read since my last A. Merritt story. I enjoyed every bit of it.

"Mr. Ellerbee Transplanted" is a gem of humor. More power to Jan Formau! I derived real amusement from this story.

"Out of Night" and "A Menace In Miniature" rate a fair amount of applause, though by no means as good as the first three I have listed.

The two science articles, "Ra, the Inscrutable" and "Sleet Storm" were both instructive and highly interesting to me.

I have read science-fiction stories since 1923,

including many of the best ever written. When I was a kid, I devoured any stories relating to things out of the ordinary. My first science-fiction story in 1923—"The Metal Emperor," by A. Merritt (*the* master of fantasy)—converted me to science fiction right away.—C. H. Osborne, 5 Hill Street, Sheldon Springs, Vermont.

More by Dr. Smith—but he writes slowly.

Dear Editor:

I heartily enjoyed what I have read of Mr. E. E. Smith's latest, "Galactic Patrol." Please give us more stories by him. Also, ask him to write another of his stories of the adventures of the "Skylarkers." I think Mr. Smith is the best author of high power science-fiction there is.

I enjoyed "Released Entropy," but I did not like "Marmorro" or "The Isolinguals."

Please continue your science articles and those on our solar system.—Herbert Menzner, 1017½ Third St., Sacramento, California.

"Suggestion——"

Dear Mr. Burks:

I have just finished reading your very remarkable story, "Golden Horseshoe," in the November Astounding Stories. I wish to express my great appreciation for this story.

I could not help but think that you had in mind the book, "Unveiled Mysteries," by Godfrey Ray King, which in one of its parts treats of the great antiquity and meaning of Yellowstone National Park, speaking of the Greatest Gold Mine the world has ever known being found there in ages past. And also of the Mine of Yellow Diamonds, of which you make no mention in the story. Whether the idea of the Golden Horseshoe is fabled or not, I do not know, but you have certainly made an interesting story out of it.

I was especially impressed by the idea of the door which opened at the shadow of the accredited individual, and which sealed itself up into original rock when the visitors had passed through it.

I happened to see a mention, today, of the Calaveras Skull, discovered in 1880, in California, found in a Tertiary deposit supposedly too ancient for man to have ever been in, and this reference caused me to decide to write you about it. Colonel Churchward says that man originated in Mu in the Tertiary Period, and there are strong indications, in my mind that he "began" long before that.

I am especially interested in anything, story or activity, that tends to show that the old hidebound ideas and conceptions of the past are being done away with, and people are beginning to think freely and without bondage to the "Proven Fact."

I was pleased that you did not "do away" with Carden, as is usually done, because it was too outlandish to be true, but you merely did away with the mechanism because you did not want all that gold to come into the world at once. Remember, Tatum can still go back to that door, and it will open for him, also for the Doctor. So you haven't gotten rid of Cardan after all.—Sylvanus K. Post, 6104 Garden Ave., West Palm Beach, Florida.

"And Answer——"

Dear Mr. Post:

Thanks very much for your letter. But no, I've never heard of "Unveiled Mysteries." The legend of the Golden Horseshoe was told to me as simple fact by Dr. J. C. F. Siegfriedt of Red Lodge, Montana, while he was driving me to the entrance of Yellowstone—the new north entrance—just about a year ago. As to the fossilized primate—well, I saw that in the good Doctor's office in Red Lodge before leaving that place, and Siegfriedt told me how it had been found, and where, and that paleontologists, including some connected with the Princeton Extension, located on Siegfriedt's land in and about the Beartowa Range, insisted that it was sixty-three millions of years old. Siegfriedt left me in his office an

hour to study the thing, since I felt there was a story in it.

Nor have I heard of the Mine of Yellow Diamonds. I intend to write Siegfried at once—note he is mentioned by name in the story, with his permission—and see whether I can dig up a yarn about that.—Sincerely, Arthur J. Burks.

"Yes, definitely,"

Dear Editor:

Up to now there has only been one author of science-fiction who could remove you from the everyday world without spending pages on useless theorizing and technical data. That was Stanley Weinbaum. He has had countless imitators, but the very fact that they *were* imitators prevented them from approaching this fine level. I had almost despaired of ever finding a story to rank with "Worlds of If," but suddenly, in the November issue I happened across a little fantasy entitled "A Surgical Error." It was the only story of interest in the entire issue, to me.

It's author, a Dr. Coole, has successfully told a simple little tale, with—miracles of miracles—an original idea! His style was simple and light. I imagine that is why his short was so entertaining. If Dr. Coole can come across with another idea as interesting he will definitely be on his way to the top.

Concerning your new question: "Should Brass Tacks be reinstated?" Yes, definitely! You may recall that I was one of the many who were afraid of the advent of Science Discussions. I was subsequently won over, but since that time I have noticed an abundancy of "talking through hats" in the column. It seemed quite boring after the twentieth argument with no one in particular, concerning Atlantis, was printed. The column has, in the short period of one year become a forum of ponderous calculations, and a stage where text-book Physics could be blatted to see one's name in print. I will admit that there are many sincere and interesting letters published, but I for one would like to know what my fellow readers think of the magazine, rather than what they think of reproducing page ten of Elementary Chemistry. If they must continue the argument on Atlantis, let them do so privately.

In summation of the above, how about a half and half combination of the two columns?

And now, if I'm not running overtime (hint to Mr. John W. Campbell, whose letter in November Science Discussions hogged about three complete columns) I'd like to say a few disparaging words about some of the stories.

1. "Galactic Patrol." The good Dr. Smith, Phd. D., etc., is doing a splendid job of being long winded at one cent per word. Part two of his "epic" is just a little too deep for me, what with thought-lents, and winged bogeymen. This type of story *does* serve one purpose, though. It makes me long for miniature gems like "Mr. Ellerby Transplanted" or above mentioned "Surgical Error," whose authors apparently are not so interested in using big words as they are in having an intelligently entertaining plot. There is enough material in "Galactic Patrol" for five or six different plots!

2. To the Artists: Please, please, Mr. Wesso, Marchioni, Dold, get together and stop illustrating every story with balloon-like space suits or hazy, gray-charcoaled machinery! Can't you show the human interest part of the tale, instead of always drawing the same darned thing. —Gerry Turner, Hotel Bretton Hall, New York City.

First Letter In.

Dear Editor:

The two best improvements you have made in the Astounding Stories in the last few months are Wesso's covers and the return of Brass Tacks. I'll bet I'm not the only reader who whooped with joy when he looked at the contents page of the November issue and saw our good old readers' department listed there. Science Discussions has been interesting, but there has always been something lacking in it.

I hope you are going to stick to the system you have adopted in the November issue, making Science Discussions and Brass Tacks one

department with those two parts: one, to stimulate the readers to voice their scientific opinions in controversy, the other, in which we can get together as we did in the "good old days." One doesn't like to feel that he is the only science-fiction nut in the world, and the old Brass Tacks was a good way of keeping him assured that he wasn't. I, for one, can feel a lot more enthusiastic about the argosy of science fiction if I know that it isn't a sinking ship.

Just to start again in the spirit of the old days, I'll pick apart the November issue, although I haven't yet read it all. The cover: Wesso's done better (for instance, on the June cover) but it's better than any Brown has drawn. I've grown so used to the big red square in the lower right hand corner that it doesn't bother me any more. The illustrations: Dold has improved in his drawings for "Marlnorro" and "Cosmic Ray Shields"—drawings aren't so dark as formerly. Wesso's at his best in this issue, especially in the drawings for "Galactic Patrol." Jack Binder—improving. The stories. As much as I've read of it, "Galactic Patrol" is Smith's greatest yarn—it's wonderfully written and fast moving. "The Golden Horseshoe"—have just started reading it. Style better than Burks's usual. Apparently he has spent a little time on this. Looks good. "Lost in the Dimensions"—Schachner at his best, which is nowadays none too good. Roger Bacon and John, the son of Dominick, were enjoyable characters. The plot, for once, contained a slight trace of originality. Fred was a little too quick on the draw in erasing Mardn, however, and a bit too brave in rescuing the beauteous heroine. If Roger Bacon had landed on the sun with the dimension machine, he could not possibly have lived the thousandth part of a second—certainly not long enough to: "in the last gasp, turn the ball" and send the machine to safety. In less time than the sensations could have traveled to his brain, he would have been destroyed by the terrific flood of radiation. "A Surgical Error"—a clever piece of fantasy. Excellent reading.

The other stories I haven't read yet, but they look good.

I guess it's about time to close now, but I'll wind up with one finishing whoop, "Ray for Brass Tacks!"—Oliver Saari, 722 Penn Avenue North, Minneapolis, Minnesota.

Bibliography? Try "Chemical Abstracts."

Dear Editor:

Your development of Science Discussions was a noteworthy step forward; your abolishment of Brass Tacks was not. Certainly the reader who is not particularly interested in detailed scientific and technological argument has as much right to express himself as those whose inclinations do lead them to these forms of intellectual diversion. I, therefore, heartily commend the proposed return of Brass Tacks; but if you take Science Discussions out, that would be much worse. Let's have a 50-50 share of both: don't let either party play the hog.

I'm still looking for that bibliography you promised me. Take, for example, the article on "Cosmic Ray Shields." This is something I am interested in and would like to read up on, but what is there in the article to give me any help? Now, if a reader makes a suggestion, he has no right to resent it if the editor can't use it, but when the editor says "O. K., we'll do that," and then doesn't, the reader has a perfectly legitimate grievance.

You get busy or I'll sic the League for the Inclusion of Bibliographies in Science Articles (known, of course, as Libsa) onto you!!

I am very much annoyed with Jack Williamson for writing Part Two of his "Released Entropy." Part One was a complete, perfectly legitimate story with a splendid—if tragic—ending of good literary merit. Part Two, apparently written under protest in response to the bleary editorial formula "gotta hava happy ending gotta hava happy ending gotta hava happy ending gotta hava——" is some of the worst and most hackneyed stuff you have printed in years. That phony cycle Williamson rings in on us is not only far too reminiscent of another story you printed a couple of months ago, but is sheer hack writing on a theme long since exhausted.

Dr. E. E. Smith and John W. Campbell, Jr., have dominated your magazine for the past

three issues—Sept., Oct., Nov.—with the one exception of Don A. Stuart's well done "Out of Night," rating two and a half, and up to the best science-fiction story that has been printed in 1937—the unforgettable four star "Forgetfulness" in your June issue.

The continued absence of even one good short story an issue harms your magazine more than you may realize. Eando Binder has written good yarns—his "Dawn to Dusk" was wonderful—and Stanton A. Coblentz has an imposing reputation, but their pot-boilers in the September issue were so pitiful I scarcely have the heart to criticize. "The Isolinguals" had an idea, no organization, while "Air Space" did not even have an idea. "Past, Present, and Future" bats out an even 2 stars, and "Galactic Patrol" at present rated 3½, may develop into 4.

For October, "Mr. Ellerbee Transplanted," "Rule of the Bee" and "A Menace in Miniature" do not deserve even an energetic "Phooey." "Penal World" is slightly more promising, but the theme dates back to the "Outpost on Ceres" and has been a favorite right through "Perihelloa." Still its a good theme! "Stardust Gods" is spottily and vaguely written in places but still manages to be better than the short stories. Better than Sept. by the margin of "Out of Night."

November I have not had time to read through yet—just out today—and Warner Van Lorne will disappoint me if he doesn't turn out a short better than those you've had lately.

To summarize, you still print better serials and slightly better novelettes—numerous exceptions—than your competitor, but their short stories are much better than yours. Read them and see. In fact, "the best magazine of science-fiction on the market today" does not necessarily mean Astounding, though you have an almost overwhelming advantage in nearly every way. I would hate to see you slack off the steady progress you have made since you took over. To a reader who ran remember back to when stories like "Beyond the Sphinx's Cave" were published as—God save the mark—science-fiction, you have wrought miracles, and if I seem to carp and criticize to an unnecessarily severe degree, it is only with the hope of seeing more miracles develop.—Louis Russell Chauvenet, Matthews 59, Cambridge, Massachusetts.

Sc_3 Fi_3 Fa_2 Maybe?

Dear Editor:

The recent superfluity of articles in the magazine has definitely prompted me to hie me out of the doghouse where I have remained a many-yeared (no pun intended) yet silent fan and add my effervescent growls and burps to ye B.T.'s before the d.t.'s.

Doubtless this barrage of science is well meant, but why not keep it in the stories rather than fill seventeen whole pages with articles (November, 1937) and then fill roughly 5½ pages with discussions whereln Messieurs Campbell, McCann et contemporaries continue the theory-slinging and etc.

Of course if you intend to follow the trend of another S&S publication which I've read since birth (its, not my humble naissance) namely Bill Barnes which started as a fiction mag and evolved into a very fine aviation mag with fiction as a sideline, well, that means a gradually increased number of articles and we, the fiction seeking fans, will be sustained with a couple of shriveled morsels of scientifiction per month. This trend seems very obvious and I'm sorry to see it since I consider s.-f. the tops in literature-of-escape and hence dislike to see it become burdened with too much science within and around same.

Why not keep the contents in coherence with the name? Why not have stories (rather, more of them) with the Weinbaum, Wandrei, Moore and Stuart touch—science-bearing stories with genuine human emotions, human gains, human losses, the effect of science on man and man on science, not as it is but as it might be.

I don't mean to let fantasy run riot and toss science to the jackals, mix 'em up! One doesn't see chemicals running around raw; why give us science raw? Let the fiction continue to teach as well as entertain.

Personally I can usually find time to read worthwhile stories, but what with free-lancing a little myself, reading divers and numerous mags and etc., I rarely find time to digest science

articles which belong, anyway, in non-fiction scientific periodicals.

As a whole, the fiction has been quite nourishing of late. Since this is my first fan-letter, let me state that my favorite yarns are C. L. Moore's "Greater Glories," Weinbaum's "Red Peri," Williamson's "Legion of Space," Zagat's "Spoor of the Bat," Stuart's "Frictional Losses," and practically everything from Van Lorne and Gallun, particularly Old Faithful yarns and 7758.

Count me in as an avid supporter of "The Shadow Out of Time." "Mountains of Madness"? Nix! Schachner et Binders et Eric Frank Russell (John Russell Fearn?) (Pelican West was great, by the way!) wax greater.

Am pleased to see Jack Binder gracing your pages. His major illustration for "Forgetfulness" and for "Queen of the Skies" smack of genius. Please keep Brown on cover and give us more interplanetaries (i.e., *different* interpretations) and above all more fiction and less articles, more Brass Tacks and less discussions, more Moore, Van Lorne, 775 and Jack et freres Binder.

Yours as I hie me back into ya doghouse to polish up a s.-f. yarn of my own which'll soon hit your optics.—John Victor Peterson, Pare-Aux-Pins, Pomfret Center, Connecticut.

Artists.

Dear Editor:

In the last issue of the magazine I saw the old head for Brass Tacks and your statement asking if we want the resumption of that very noteworthy column. Of course we do!

Although I hadn't realized that we could have both Brass Tacks and Science Discussions, I know many of the readers will feel as I do, for I am one of the faction who enjoy science-fiction mainly for the new and pleasing ideas offered, for the chance to escape into the more vivid and exciting realms of the imagination. And I speak with the viewpoint of reader, author and publisher so can give more varied opinion.

In the last issue of the magazine the progress shown does my heart good. Although the story by Burks wasn't a story to lose your head over, it shows a betterment of style over his previous works—which is a good sign. Van Lorne's "Marinorro" is very good—quite different than his usual must-have-a-sequel type. Binders (Earl, Otto and Jack) have a very pleasing combination. That illustrator is plenty good. I don't like to see so many science articles.

So much for now—just to ask for the resumption of Brass Tacks, more Van Lorne stories, more Binder illustrations and more Wesso covers.—Russell A. Leadabrand, Box 264A, Route 2, Dinuba, California.

Thank You!

Dear Mr. Campbell:

The main reason for writing this magazine is the revival of Brass Tacks. It was a great mistake to stop this department for the letters of us fans. Now I am glad that it was restored.

Also, I am very glad to hear that you have been made editor—even though you probably won't write any more stories. I was informed of the fact that you have been appointed editor by "The Science Fiction Fan."

The stories in the November issue were only fair, but the return of Brass Tacks made up for it all. Since we have Doctor E. E. Smith with a serial, why can't you get Clark Ashton Smith, John Taine, and Abraham Merritt? These authors are the top-notchers, who always turn out good stories. Maybe that's because they take a long time to write their stories, whereas, some of the hacks (yes, I said hacks) turn out a new novel every day.

About the cover: give us more Wesso. He's one of the greatest artists, second only to Virgil Finlay. Also, can't we get Frank R. Paul to do some illustrating? Mr. Paul is wonderful on machinery as he has so ably proved by so many of his covers on other science-fiction magazines.

I'd like to hear from some fan who has the following fan magazines; Science-Fiction Digest, Time Traveller, and Unique. Please send the prices, and if they are reasonable I'll buy.

With best wishes for the future.—Louis Kuslan, 170 Washington Avenue, West Haven, Connecticut.

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